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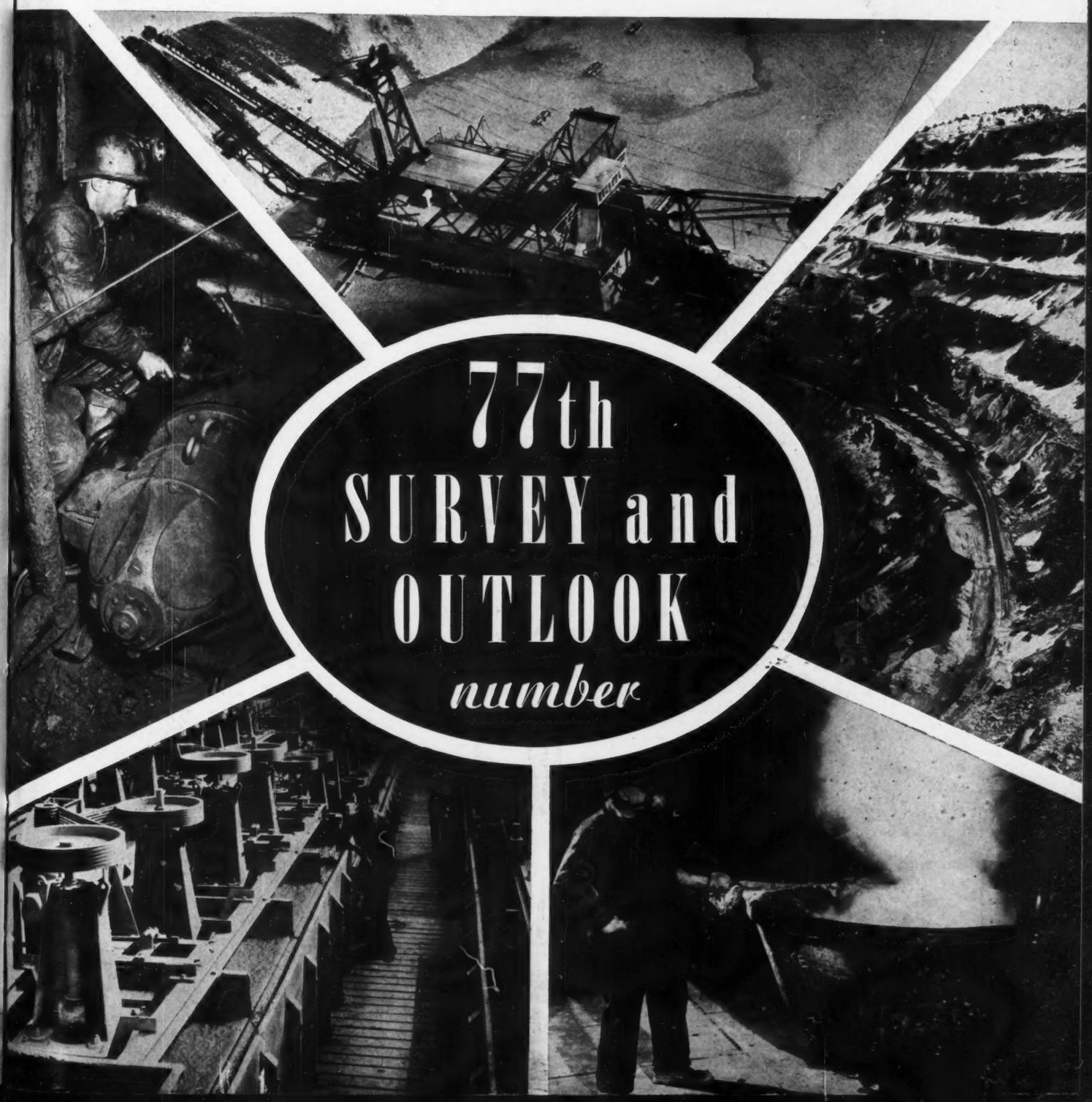

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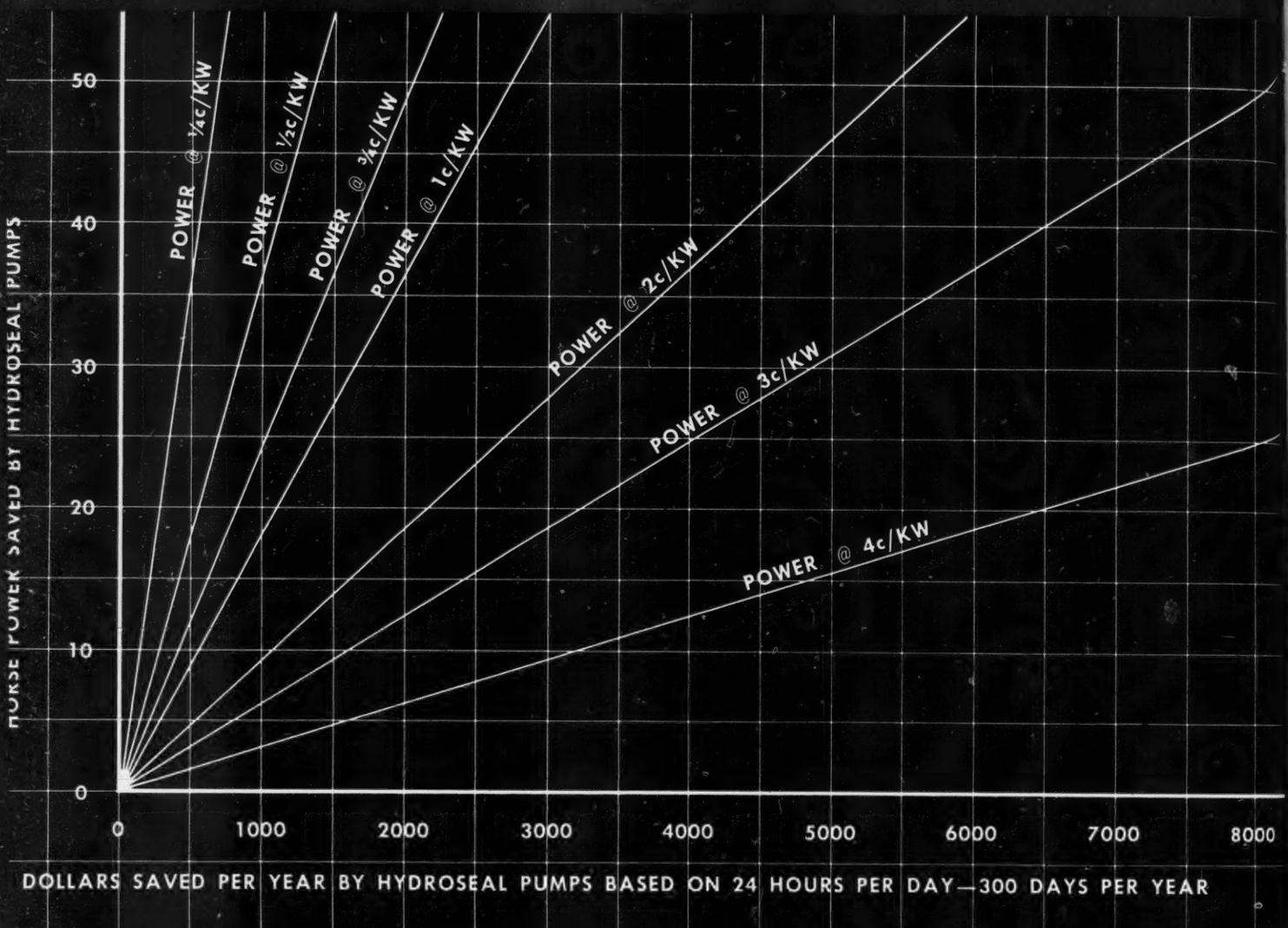

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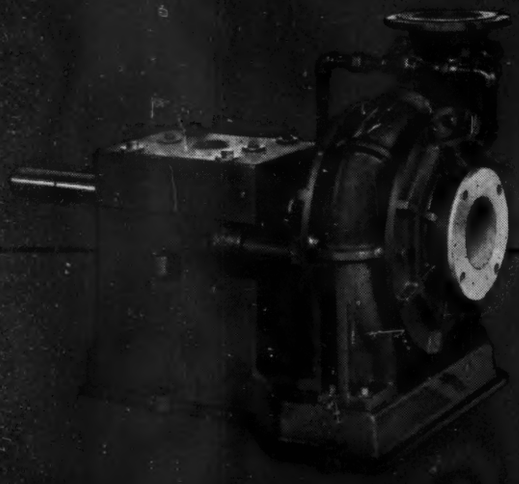

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ENGINEERING AND MINING JOURNAL

February, 1946

Mining Industry Faces A Fateful Year

EVAN JUST, Editor

Summarizing the outlook, it is probable that the large markets which 1946 promises to offer will assure most of the industry an active year; however, the decisions on tariff and taxes which will be made this year will profoundly affect the future of domestic mining. These problems and the industry's internal ones, including labor relations, modernization of processes and plants, progressive research, and the improvement of opportunities for able men, all merit vigorous attention. Also, the future course of the industry will be strongly influenced by the decisions of the rank and file of mining workmen. Will they recognize their vital stake in our industry's future and act as members of the industry? Or will they resign themselves to remote control and become robots in the revolution of the world proletariat?

THE BEGINNING OF 1946 finds mineral markets in far better condition than producers had dared to anticipate during the war. Despite strikes and the threat of strikes in heavy industry, the pent-up demand for durable goods continues to call for a strong flow of mineral raw materials. This points to an unprecedented peacetime market when reconversion is completed, strikes are settled, and orderly progress is resumed in countries that have been damaged or held back by the war. Given reasonable political and financial stability, the world demand for minerals in general should tax the capacities of all established sources of supply. The general trend of prices is definitely upward.

The impressive requirements for new construction, industrial and residential, particularly in the United States and war-torn Europe, will probably be powerful factors in sustaining mineral demands for some years to come. The ambitions of Oriental people to industrialize and to improve living standards also promise to bolster markets. Excepting iron and aluminum, for lack of suitable ore deposits the Orient is not likely to increase metal production in consonance with increased requirements.

Higher Production Costs

On the production side, the war has not greatly altered the mineral map. The net change is unquestionably in the direction of higher costs, both because of world-wide price and wage inflation and

because in general depletion has been more conspicuous than the development of new sources of production.

For most minerals, the United States is no longer in a position to outproduce its requirements. Canada's position is roughly the same as prewar—possibly somewhat improved. The status of Australia and the Far East is certainly not improved, and has probably declined. The Burma lead-zinc mines are reported to be depleted. Africa is on the upgrade. It and the Soviet Union seem to be the areas most likely to expand production-wise. However, it is doubtful that the USSR will be an important mineral exporter. A state-controlled economy, Russia is likely to favor retention of its irreplaceable resources and export of replaceable ones. Even its gold policy remains shrouded in mystery. The Soviet Union is reported to have a large gold stock, and the internal need is not self-evident in a country which settles doubts about its currency by force. Nevertheless, there is no present indication of a Russian desire to export gold.

Europe, which before the war supported much of its production for military purposes, will certainly produce less in comparison to its requirements. In Latin America, new developments scarcely make up for the depletion of established sources, and the leaning toward burdensome taxation of the mineral industry does not portend a strengthening of productive capacity. All in all, it seems as though expanded deficits in Europe and the Orient, plus new deficits in the United States, will more than make up for any likely growth of surpluses in other areas. Thus, it appears a certainty that mineral prices will be higher than before the war in relation to other commodity prices. Furthermore, the world over, prices in general are bound to increase, as governments are displaying their traditional tendency to solve financial problems by courting inflation instead of meeting problems the hard, honest way.

Stockpiling Expected

A supporting influence in the markets, which is likely to do much to ease any possible threat of burdensome surpluses, is the Government's program for stockpiling strategic materials, most of which are minerals. A bill to enlarge the scope of stockpiling and set up a permanent administrative agency has been passed by the Senate and will undoubtedly pass the House during the first quarter of 1946. It seems certain that stockpiling needs will absorb virtually all the mineral surpluses left over from the war in Government hands. In the case of most of the commodities involved, including copper, lead, zinc, and tin, substantial additional purchases will probably be made.

Although the stockpiling program will undoubtedly have a beneficial effect on metal markets for some time, it is possible that eventually the advent of atomic means of making war may reduce stockpile requirements and call for partial liquidation of Government stocks. Large stockpiles are precautions against long wars. The effect of a weapon which may decide wars in days or weeks rather than years, or may lead to effective steps to prevent war, is self-evident.

Tariff Cuts in Sight

One of the most puzzling economic factors to predict is the extent to which the Government will continue to give support to domestic industries that cannot compete in a free-trade world and carry the high wage levels that are characteristic of our economy and supported by Government policy. Ever since George Washington's administration, our Government has protected vulnerable domestic industries. Most other nations do so, and, except where we undertake to support their economies with loans of dubious collectibility, seemingly intend to continue.

However, our Government's economic and social policies today are strongly influenced by academic thinkers who lean so strongly toward free trade that they are willing to disregard the particular problems of various domestic industries and to dispense largesse on a grand scale in order to secure international acceptance of their views. Whether or not they can establish a free-trade world before the taxpayers call a halt or the dislocation of domestic industries overwhelms them with protests is an open question.

The State Department is now preparing for an international conclave to reduce barriers to trade, and to substitute government cartels for private ones. The zeal of our economic policy makers to lead the way toward free trade, plus their disinclination to heed the views of conservatives, in and out of Government, point strongly toward a new cycle of tariff reductions affecting minerals, including copper, lead, and zinc.

Protectionism Not Dead

It is possible that as long as there is a great backlog of unfilled consumer needs, and consumers either possess or can borrow the liquid assets necessary to fulfill their wants, markets may be large enough to call for all the minerals which established sources of production can conveniently produce. If this occurs, the ordinary effect of tariff reductions may be suspended until more competitive times. However, when the pressure of competition becomes normal, it seems likely that protection of domestic industries will be resumed, if

not by tariff, then by direct subsidy. Protectionism is firmly established in human behavior, and will probably survive Uncle Sam's ability or willingness to finance a bright, new world. Protectionism is merely one aspect of nationalism, and political and economic nationalism go hand in hand. The painful slowness and backsliding with which political internationalism advances, even with the atomic bomb overshadowing the outlook, is a clue to the probable rate and pattern of growth of economic internationalism.

Nevertheless, for the next year or so, probably Uncle Sam's credit will be effectively used to secure compliance with the aims of our Government's economists. Undoubtedly the widely publicized view that we have become mineral have-nots will be used as an excuse to make further reductions in mineral tariffs, despite the anti-conservational consequences of discouraging domestic mining. Public misunderstanding of mineral "have-not" ideas constitutes a situation which domestic mining will ignore at its peril.

Gold a Puzzle

The gold outlook remains a puzzle. Gold prospecting, development, and production are booming, despite the worsened economic position of the producers, who are faced with higher wages and supply costs without a change in the gold price. Obviously this optimism anticipates a higher price for gold. Just why gold will enjoy higher prices in a world where governments are afraid to allow the holders of their paper an opportunity to possess gold is not self-evident—in advance of currency devaluation. Presumably the gold investors expect devaluation in due course. This attitude is not without a reasonable basis. As long as our Government, whose purchasing policy is the most powerful influence in establishing the world price, fails to demonstrate ability to reduce its debts, devaluation and a return to redemption of paper in gold remain reasonable possibilities. This, however, is not likely to happen in 1946.

Silver Rides Again

Silver also is enjoying a boom. So many people in the United States have the money to gratify their taste for silverware that silversmiths are calling for domestic as well as foreign silver and are willing to pay the Government domestic price in order to get it. With production at the mines limited by a short labor supply, the silver users are anxious for re-enactment of the Green Act, which gives them access to Treasury "free" silver. They

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WHEN DOCTORS DISAGREE

Elmer W. Pehrson, U.S. Bureau of Mines:

"... we are far from exhaustion of those mineral resources that are basic to our industrial economy. However, exhaustion is well advanced in a number of important subsidiary minerals so that we can no longer drift along with the easy-going philosophy that the earth will provide."

—Mining and Metallurgy, April 1945.

American Mining Congress:

"The men best qualified to know, by training and first-hand experience, say most emphatically 'this is not a "Have Not" nation so far as metals and minerals are concerned — nor is it likely to become such.' "

—Resolutions of Western Division, Salt Lake City, Nov. 1945.

W. E. Wrather, Director, U.S. Geological Survey:

"On the basis of present knowledge of our mineral resources, there is reason for pessimism as to our supplies of some of the supposedly common metals. Their production during recent years has not been balanced by comparable discoveries of new reserves. Our current situation seems to indicate a trend toward imminent national shortages."

— Before Nat'l. Foreign Trade Council, November 1945

"The Geological Survey is unwilling to accept the discovery rate of recent years as a gauge of our future expectancy. . . . I have enough faith in a bounteous nature to predict that in a land of such wide diversity and size as the United States, we will eventually come to realize that great mineral resources remain to be developed."

— Before Colorado Mining Association, January 1946

C. K. Leith:

"The United States has been the most self-sufficient country in the world in regard to minerals, but it has always needed supplementary supplies from outside. From now on, these needs will grow both in volume and variety because of expansion of our industrial and security needs due to the fact that we have used up our resources more rapidly than any other country and because the rate of discovery is steadily declining."

—Mining and Metallurgy, January 1946.

Harvey S. Mudd, President, A.I.M.E.:

"The Cordilleras of North and South America from Alaska to Cape Horn have been prospected and yet reasonably close geologic work has covered only a small part of this broad and long mountain chain from which much of the world's mineral wealth has come. Within it must be great ore bodies that do not outcrop and which will some day be discovered by new techniques."

—Mining and Metallurgy, January 1946.

Harold L. Ickes, Secretary of the Interior:

"The prodigal harvest of minerals that we have reaped to win this war has bankrupted some of our most vital mineral resources. We no longer deserve to be listed with Russia and the British Empire as one of the 'Have' nations of the world. We should be listed with the 'Have Nots,' such as Germany and Japan."

—American Magazine, December 1945.

would like it at 71 cents. The Congressional silverites are determined that they shall pay more, and are asking $1.29, the melting point of silver dollars.

Nobody can safely predict how long these high silver prices will last. Being based essentially on free public spending, they will probably survive as long as the postwar boom continues. When that is over, much will depend on what is done in the meantime to widen industrial applications and to obtain recognition of silver by other nations as a currency base. No progress has been made in the latter direction during the past few years, nor is it now being made.

Premiums May Continue

Currently a considerable part of the industry is still receiving subsidy payments under the Premium-Quota Plan. Up to the present the general attitude of the mining industry and the public has been unfavorable to the continuation of subsidies. Therefore, it is generally expected that the Premium-Quota Plan will probably not be renewed after July 1.

Most thinking has presumed that the ending of premiums would naturally be accompanied or preceded by raising of the price ceilings on copper, lead, and zinc. This view is based on the knowledge that the present ceiling prices without premiums would not support the present mine output of these metals. However, considering the poor showing that is being made toward controlling inflation on the wage, production, and Government-expenditure fronts, it seems likely that dangerous inflationary pressures will still exist on July 1. Being particularly reluctant to permit prices of basic commodities to rise, the Office of Price Administration may conceivably persuade Congress to continue the Premium-Quota Plan until the danger of runaway inflation is lessened.

Taxes Menace Progress

The tax outlook remains ominous for people who are inclined to invest in or promote risky ventures like the development of new mining properties. True, the excess profits tax has been repealed, but with a Government that has no real hopes of reducing its budget below twice the prewar level, it is obvious that taxes will continue to be heavy. Probably on the whole they will be more burdensome than during the war, as, although taxes may drop from $45 billion to $25 or $30 billion, the rate of Government spending may drop from $97 billion to about $30 billion.

With this outlook, it is evident that the mining industry must exert every effort to obtain tax concessions that will give the risk-taking investor a chance to overtake the losses from unprofitable ventures when he scores a "win" over natural hazards.

Labor's Remote Control

During the war most mining executives became convinced that they would have to live with the inflated wage levels which had been established, even though ores being mined are constantly becoming lower in grade or less accessible. Their hopes for survival were based pretty much on the belief that the low average efficiency of labor in wartime will improve when labor becomes less scarce.

However, it now develops that important segments of mining labor are not only going to demand retention of wartime wages, but want a 30 percent increase to boot and are prepared to strike to obtain these ends! This, of course, upsets all previous calculations.

What does this action mean? Are mining workmen aware that by such a course they bid fair to reduce drastically the number of jobs which the industry can provide? Or do they believe the inflammatory propaganda printed in union newspapers, and concur that management is composed of rascals and royalists whose claims cannot be trusted? Or, do they simply not think these matters through, and blindly obey the behests of union leaders? Seemingly, by its willingness to embrace objectives dictated from afar by labor leaders who think in terms of class warfare, at least a part of mining labor is unmindful of the industry's predicament. Only from general distrust of management, from class consciousness, or from ignorance could workmen agree to strike for fantastic wage demands when it is so completely evident that domestic mining is confronted with high costs, declining grades of ore, burdensome taxes, reduced tariff protection, and substitutes for many of its products.

Unfortunately for domestic mining, and the jobs it provides, although labor may be able to force higher costs on mining employers and higher prices on consumers, it cannot prevent consumers from using substitute materials or from buying in foreign markets. Curiously enough, the CIO, which has initiated the 30 percent demands, has also endorsed a policy of lower tariffs. Under these circumstances, when our mining labor asks for wage increases without offering a practical method for increasing labor's productivity commensurately, it is really asking for fewer jobs and a restricted future. However, the fact remains that the demands are being made, and, what is fundamentally more important, metal mining labor, always notable in the past for its American individualism, is accepting remote control.

METALS IN REVIEW

GOLD

World production was 40 percent under the peak of 1940. Operators in the industry are optimistic as wartime restrictions are relaxed

EACH YEAR it is more and more difficult to appraise the role of gold in the modern economic system. For a commodity so intimately tied to the system, 1945 was essentially a transitional period for which it is difficult to trace an authentic trend. On the surface it would appear that the world now has far less need for new production of the metal than before the crisis of the 'thirties. It seems certain, however, that producers everywhere are not measuring the future of gold in pessimistic terms, and fiscal authorities generally appear to feel that the metal still has a very definite place in their monetary calculations.

In the fields which affect gold particularly, two world wars and an economic depression have produced fundamental changes in the technical approach to economic and financial problems. The changed approach in the manipulation of public credit is a case in point. During the war, it was absolutely necessary for most governments to divorce their currencies from a gold metallic base and to depend on direct control of prices and production. This control had some faults, which were widely decried, but, generally speaking, people came to recognize that even a great war need not bankrupt a country if it can retain its productive capacity. The circulation of gold has been used as a control instrument in some countries highly susceptible to hoarding tendencies, but always with the open recognition that the extreme position of these countries arose directly from the scarcity of goods, which could not be remedied perceptibly until this lack was supplied. In direct contrast was the general acceptance of the reduction in the gold reserve ratio of the Federal Reserve Banks from 40 to 25 percent, while an alternative suggestion that the greatly expanded volume of notes and deposits be handled by increasing the price of gold met with unfavorable news comment on the basis of its inflationary possibilities.

Acceptance of the Bretton Woods pact, creating an international exchange stabilization fund, is additional evidence of the leaning toward technical solutions of problems which in the past have been difficult to manage in any other way. The Fund is expected to eliminate exchange upsets by drawing on a central pool of gold and national currencies for the relief of countries temporarily short of the means to meet their balance of payments needs. An implied function, important to the Fund's continued operation, is the demonstration of the economic interdependence of all members and their responsibility for adjusting domestic policies to the common need. It is therefore expected that the Fund will eliminate to a considerable extent the stringency in normally weak currencies by forcing the countries with stronger units to give the weak countries greater opportunity to trade. Furthermore, if a revision of commercial policies on a world-wide basis takes place, international transactions should prove to be better balanced in the years that are ahead than they have been in the past.

Redistribution Desirable

The needs of the world economy would best be served if there is a moderate but persistent tendency for gold to flow from the United States to other countries. Both the United States and foreign nations would gain from the redistribution of reserves; and this redistribution would be the best assurance the world could have that

it would not suffer a dollar shortage for a long time to come. A balance of international payments for the United States of this character would be a major contribution toward creating the kind of world envisaged in the Fund agreement. It would relieve international trade of some of the chief pressures that forced the exchange depreciations, exchange controls, and other throttling measures of the 'thirties.

The idea that the best form of international balance would be one which would tend to redistribute the surplus in the United States gold stock may run counter to a feeling that equilibrium without gold flow is somewhat natural and right. According to this view, the right exchange rate is one which tends to balance a country's international transactions without any movement of reserves. Accordingly, if South Africa and Canada and other countries are to continue producing and exporting hundreds of millions of dollars of gold a year, the receiving countries must as a normal thing be sufficiently out of balance to require payment in gold.

Many foreign countries would be more secure with larger gold reserves. Such reserves in their hands would enable them to pursue their employment and production programs with greater boldness and without interruption from temporary irregularities in their balance of international payments.

Producers Optimistic

Nothing seems more certain, however, than that producers are optimistic over the future of gold. Officially and unofficially, the mines are being given encouragement to get back into production. On June 7, Canada lifted restrictions on shaft sinking and other developments. On July 1, the War Production Board permitted the resumption of gold mining in the United States. On June 9, the British Treasury announced an increase in its buying price for gold from the sterling area as a consequence of lower shipping costs. The industry needed no bolstering of its already strong confidence in the opportunities of the postwar period. It appraised Bretton Woods as an assurance of the re-establishment of the gold standard on a basis which would facilitate return to prewar production and, even more importantly, would permit an extension of output through new discovery and development. The prospect of rising costs, as represented by the present price and wage levels, has been somewhat of a cloud on the horizon, but some operators have not ruled out the possibilities of offsetting windfalls in the form of lower taxes and increased selling prices.

The gold-mining industry is very speculative and thoroughly imbued with optimism. However, it seems reasonable to question whether its tendency to ignore the unfavorable technical factors in the outlook may not be due in some measure to the appearance of confusion which government policy on a world scale presented during the war years. In the initial stages of the war, the maintenance of a large gold output throughout the British Empire seemed of paramount importance as a means of obtaining the necessary dollar exchange to finance war imports. By the end of 1940, however, the exhaustion of the United Kingdom's reserves and the increasing magnitude of the war supply program had demonstrated the futility of continued reliance on traditional methods of finance. Thereupon the industry ceased to receive special encouragement, not only because other financing methods were adopted but also because the pressure on supplies and manpower was held to warrant their diversion to the production of goods of strategic

World Gold Production by Principal Reporting Areas
(in millions of ounces)

Principal Reporting Areas	(a) 1945	1944	1942	1940	Percentage Decrease 1944–1945	Percentage Decrease 1940–1945
North America	3.5	3.9	8.6	11.3	10.6	68.8
United States	1.0	1.0	3.7	6.0	6.7	84.1
Canada	2.6	2.9	4.8	5.3	12.0	51.6
Latin America	0.8	1.0	1.0	1.1	15.7	26.6
Colombia	0.5	0.6	0.6	0.6	16.4	26.7
Chile	0.2	0.2	0.2	0.3	18.6	51.6
Nicaragua	0.2	0.2	0.2	0.2	11.1	29.0
Africa	13.4	13.4	15.7	15.8	0.1	15.1
Union of South Africa	12.3	12.3	14.1	14.0	0.2	12.8
Rhodesia	0.6	0.6	0.8	0.8	3.9	31.1
Gold Coast	0.6	0.5	0.8	0.9	+5.1	37.5
Asia and Oceania	0.6	0.7	1.1	1.5	1.7	56.7
Western Australia	0.5	0.5	0.8	1.2	1.3	60.4
British India	0.2	0.2	0.3	0.3	9.1	41.4
Total principal reporting areas	18.4	19.0	26.4	29.7	3.2	38.1
Other countries, excluding U.S.S.R. (estimate)	3.1	3.2	5.9	7.4	3.1	58.1
World total	21.5	22.2	32.3	37.1	3.2	42.0

Source: Federal Reserve Bulletin. (a) Preliminary estimate.

importance. Although agreement on positive restriction of gold output was long delayed, the entrance of the United States into the war was a decisive influence; equipment and supplies for gold-mining activity became increasingly scarce and by 1942 production of the precious metal had begun to decline generally as indicated in the accompanying table.

Variation in Curtailment

Although production declined in all the principal producing countries, the character and extent of curtailment varied. The severest restriction was imposed by the United States in the War Production Board order L-208 of Oct. 8, 1942, which decreed the closing of all "non-essential" mines—that is, gold mines which were not primarily base-metal producers, exceptions being made only for very small lode and placer properties. No new ore could be broken out and ore above ground could be worked only for a period of six months (provided, moreover, that the operation did not consume substantial amounts of critical materials and would employ only men who were ineligible for military service and not needed in strategic mining operations elsewhere).

Production figures for 1943 and 1944 show that, with the exception of Utah, in which 92 percent of the production in 1943 was a byproduct from base-metal mines, all producing districts registered marked repercussions. The gain to the war effort in the United States seems to have consisted principally in achieving a certain saving of supplies.

In Canada, normally a larger producer than the United States, the curtailment since 1941 has been about 53 percent in production and employment. This is not equivalent to the United States curtailment by any

means, but it is large considering the importance of the mines to the northern Ontario districts, where they are almost the sole activity. As is natural in a country which has long considered gold mining as a major producing and investment interest, Canada evidenced reluctance to embark on a restrictive policy. The integration of United States and Canadian war controls throughout the whole field of production, however, made a reduction on supply and labor accounts inevitable. The mines were assigned low priorities in manpower and materials. In addition, they lost a large force to the military services. Evidence of the severity of the labor shortage is to be found not only in the declining gold recovery of the quartz mines but also in that of the base-metal mines, which were unable to maintain their early wartime peaks of production, notwithstanding the increased demand that they experienced for their product.

On June 7 last the Ottawa government announced the relaxation of the order of June, 1942, which forbade the opening of new mines and limited the monthly tonnage of mines then open to the average milled in the first four months of 1941. Revocation was accompanied by the firm warning that "mine labor is still subject to strict control by the National Selective Service, and it may be many months before machinery becomes available." It is felt in some quarters that new properties will be the spearheads of the renewed activity.

The active search for the various strategic materials that was made during the war years uncovered some important gold strikes which have provided a foundation for a booming market in gold shares recently. Established mines, on the other hand, are likely to hold back on the resumption of activities in anticipation of more favorable tax rates which will help to balance out higher operating costs.

Elsewhere Abroad

Nothing has been available concerning Russian gold production for many years except estimates of output made by institutions and individuals who have tried to follow the confused reports which have appeared in the Russian press.

Occupation of the Philippines by the Japanese took something over 1,000,000 oz. annually out of total world production since 1941; prospects are now that the Commonwealth may place increased emphasis on gold production in the postwar period. A report from the Islands is to the effect that the Government leaders would like to see the economy changed so that more rice could be grown for domestic consumption and the simultaneous decline in sugar exports compensated for by an increase in gold exports. As the equipment of the gold mines was destroyed, gold production will probably not be resumed immediately.

Production in South Africa, the world's largest gold producer, is estimated at 12.3 million ounces in 1945. This is 14.7 percent below 1941 production, the largest in the nation's history. During the war the mines did not escape the general labor shortage even though they used natives ordinarily recruited into the mining compounds practically fresh from the kraals. Large numbers of these joined the Armed Forces as auxiliaries and others went into the country's war industries. As a result, the Witwatersrand native labor complement at the end of 1944 was about 24 percent, roughly 90,000 men, less than the peak of 367,000 reached in 1942. Shortage of supplies was also a great handicap. Mining methods have had to be revised and advance development work has had to be shelved, with the result that visible ore reserves in working mines have shown a considerable decline.

With wartime taxation much higher, profits remaining for dividends have declined substantially from the prewar level. Some low-grade mines, in fact, considered closing down. To continue them in operation, the Government rebated to them from the "gold realization fund"[1] a sum sufficient to meet the cost of a wage increase given native labor in 1944. The rebating arrangement ended with the British Treasury's action of June 9 increasing the price paid for gold from the sterling area by 4s.3d. to 172s.3d. ($33.94 to $34.79) in recognition of lower shipping and insurance rates following the end of the European war. On Oct. 1, 1945, the realization charges were discontinued, giving the mines an additional gross amount of 38s.3d. per £100 on the selling price. Though these measures provided a new high price for the Union's output, the industry is still hopeful that there will be a revision of taxation, which is reported taking about 70 percent of working profits.

Long Life for the Rand

Two developments affecting the life of the mines may be mentioned. One is the study of ultra-deep mining—some of the large mines are now down past 8,000 ft., and mining at 10,000 ft. or more is being studied. This is particularly interesting because of the discovery of promising ore indications at these levels on the West Rand. A commission appointed to study the problem has recently made what is considered a mildly encouraging report, recommending that the subject be pursued further with the establishment of a research institute for practical experimental work with new mining methods and suggesting also that the expense be charged off to operating costs. Another development intimately connected with the first is the discovery of evidence of the extension of some of the Witwatersrand gold-bearing reefs into the Orange Free State. This province has not previously been a gold producer, but close drilling has now established the existence at various levels of some of the Rand reefs. No difficulty has been had in attracting investment interest in the new field, and as soon as equipment is released, it is to be given a more thorough trial. The West Rand field has also been the subject of renewed interest since the discovery of exceedingly rich ore at the Blyvooruitzicht property, which has been characterized by the local mining press as being "one of the most remarkable mines ever discovered."

1945 Production Low

Although restrictions were relaxed or completely lifted in most producing countries by the middle of 1945, gold production for the year was at a very low level. The accompanying table indicates that, despite a rising trend in the closing months, output was lower than in 1944. In comparison with 1940, a peak year in world gold output as a whole, there has been an estimated decline of 40 percent. This can be attributed either to controls on output or to shortages of supplies and labor. The extent of this decline is large enough to justify a prediction that considerable time will be required to regain the wartime loss.

[1]Although the Bank of England paid the London price for gold delivered in Durban or Capetown, the Union Government retained "realization charges," roughly the equivalent of insurance and shipping charges to London in normal times.

SILVER

Advance in price marks latter part of year. As to the white metal's future, all political and economic forces seem to be upward

DICKSON H. LEAVENS, Cowles Commission for Research in Economics

THE END OF THE WAR has brought changes in the conditions of the silver market and raised problems for the future, in which economic and political factors are mixed. Under wartime controls the large Treasury stock of silver proved useful to the United States and its allies. Now, with producers eager to increase the price and consumers desirous of holding it at the present level, there is danger that the controversy of the 1930's will be renewed.

During the first part of the year there were, as in 1944, three kinds of silver in the American market: foreign silver at 45c. per ounce for industries considered most essential; Treasury silver under the Green Act at 71.11c. for certain war industries; and domestic silver at 71.11c. for non-essential uses. The distinction between uses of Treasury and domestic silver was removed by the War Production Board on May 25; and all distinctions in use on Aug. 20. The Office of Price Administration ceiling price on foreign silver remained through the summer at 45c., but this was too low to attract metal and on Sept. 20 OPA raised the ceiling to 71.11c., thus removing all distinctions of price as well as of use.

The Foreign Market

In London the beginning of the year was marked by the change in the basis of quotation to 0.999 fine as in New York, instead of 0.925 fine, on which basis a continuous series of silver prices runs back to 1833. The London price had been pegged at 23½d., since 1941, and was raised to 25½d., the approximate equivalent for the new fineness. After the American price for foreign silver was raised to 71.11c., the London price was adjusted to 44d., equivalent to about 73c.

In Bombay, where the price in silver is quoted in rupees per hundred tolas (1 tola = 180 grains) fine, the parity of the London price of 25½d. was about 53 rupees and of the 44d. price approximately 92 rupees. Actually, in this "insulated" market, where no private import of silver was allowed, the price ranged between 139 rupees, 2 annas, the high in July, and 118 rupees, the low reached in August after victory over Japan. This high price reflected partly the general inflation in India and partly the large demand for the metal for women's ornaments, for hoarding, and for speculation. The price fluctuated with the varying war prospects, and the August victory brought a sharp decline, followed by a rise with the American price. The price of around 133 rupees at the end of the year was equivalent to about $1.07 per ounce.

Production statistics covering world output of silver in the years are not yet available. In 1940, the American Bureau of Metal Statistics estimated world production at 273,412,720 oz.

Estimated production of silver for 1944 and 1945 in North and South America is shown in an accompanying table.

Silver Production North and South America, in Fine Ounces

	1944	1945
United States	34,900,000	28,300,000
Canada	14,700,000	14,000,000
Mexico	63,000,000	60,000,000
Peru	11,700,000	11,500,000
Bolivia	6,800,000	6,500,444
Other America	7,300,000	7,000,000
Totals	138,400,000	127,300,000

Source: Handy & Harman.

Imports fell off in the middle of the year because foreign holders, especially the Mexican Government, were not satisfied with the 45c. price. Imports revived after the price was raised to 71c. in September, and total imports for 1945 should be at least as great as in 1944, or something over 50,000,000 oz.

Treasury Stocks

With the end of the war it is interesting to review the history of the stock of silver bullion in the U. S. Treasury in recent years. An accompanying table, compiled partly from published data and partly from up-to-date details supplied for this article by the Director of the Mint, shows stocks and the disposition of them since the beginning of 1939.

The figures show that nearly 1,000 million ounces of bullion have gone out from the Treasury and that the metal carried at cost in the General Fund (the so-called "free" silver) has been reduced from 1,353 million ounces at the end of 1941 to 403 million ounces. Plans for the transfer of a total of 300 million ounces to the Certificate Reserve will use 163 million ounces more, reducing the "free" silver to 240 million ounces.

Although the silver-purchase policy of the United States begun in 1933 was not justified by economic reasons at the time, it nevertheless has been very useful in wartime to have this large stock of "free" silver in the Treasury to allocate to wartime needs. It would do no harm to free the bullion in the Certificate Reserve if it should be needed; silver certificates could be replaced in circulation by Federal Reserve notes.

Silver in Congress

Not a great deal was heard of silver in Congress, but its friends were not idle, and secured the promise of the Secretary of the Treasury in July to transfer 300 million ounces from the General Fund to the Certificate Reserve, thus definitely impounding it.

In June, Senator Green, of Rhode Island, introduced a bill to extend the Green Act of 1943, which was to expire on Dec. 31, 1945, allowing the Treasury to sell silver to industry at 71.11c. This received the support of Secretary of the Treasury Vinson and of industries using silver. A corresponding bill was passed by the

House on Dec. 19, two days before Congress adjourned, and an amendment proposed by Representative White, of Idaho, to set the price at $1.2929 instead of 71.11c. was rejected by a vote of 160 to 4. The Senate, however, did not take up the bill; Senator McCarran, of Nevada, speaking for the silver bloc, said that they would oppose any sales at less than $1.2929.

In October, Senator McCarran introduced a bill to repeal Sections 6, 7, and 8 of the Silver Purchase Act of 1934, which provided respectively for regulation of silver transactions, for nationalization of silver, and for 50 percent tax on profits in silver transfers; and to amend section 4 (b) of the Act of July 6, 1939, which provided for 45 percent seigniorage (i.e., a 71.11c. price) on Treasury purchases of domestic silver, by limiting seigniorage to actual cost of coinage. The effect of the first measure would be to allow free speculation in silver again, and that of the second would be to allow the price to rise nearly to $1.29 and give large profits to those who may recently have acquired silver abroad. This bill, however, did not get out of committee.

Silver Bullion in United States Treasury. Stocks and Disposition, 1939-1945

(Millions of Fine Ounces)

	1939	1940	1941	1942	1943	1944	1945 (11 mos.)	Total
Balance, beginning of year	1,880	2,215	2,406	2,495	2,469	2,351	2,045	...
Incoming bullion: Purchases	343	208	143	62	6	0	0	762
Melted silver dollars	3	0	0	0	39	0	0	42
Outgoing bullion (see below)	—11	—17	—54	—88	—163	—306	—324	—963
Balance, end of year	2,215	2,406	2,495	2,469	2,351	2,045	1,721	...
Allocation of balance								
In Certificate Reserve at $1.29	1,004	1,081	1,142	1,173	1,176	1,176	1,318	...
In General Fund, at cost	1,211	1,325	1,353	1,296	1,175	869	403	...
Part of above balance physically loaned to war plants	0	0	0	588	829	880	878	...
Details of outgoing bullion								
Used in subsidiary coinage	17	17	54	72	77	66	55	358
Used in 5c. pieces	0	0	0	5	22	10	12	49
Total coinage	17	17	54	77	99	76	67	407
Sold to industry under Green Act	0	0	0	0	21	46	100	167
Lend-Leased to foreign governments								
Australia	0	0	0	0	5	7	0	12
Ethiopia	0	0	0	0	0	5	0	5
India	0	0	0	0	20	100	106	226
Netherlands	0	0	0	0	1	45	12	58
Saudi Arabia	0	0	0	0	0	13	6	19
United Kingdom	0	0	0	0	15	33	40	88
	0	0	0	0	41	203	164	408
Adjustments	—6	0	0	11	2	—19	—7	—19
Total outgoing bullion	11	17	54	88	163	306	324	963

Sources: Balances, from *Daily Statement of the United States Treasury.* Purchases, from *Treasury Bulletin.* Melted silver dollars, and coinage, 1939-1942, estimated from *Circulation Statement of United States money.* Coinage, 1943-1945, sales under Green Act, and Lend-Lease, supplied by Director of the Mint. Adjustments: This is a balancing figure, covering rounding off of fractions, sale of "silver ordinary," and other adjustments.

Prospects for the Future

With the "free" silver in the Treasury reduced to less than 250 million ounces after the expected transfers are made to the Certificate Reserve, even if the Green bill is passed, the world will be very largely dependent on other sources for the white metal. These will include, besides new production, some of the production of recent years which has been held off the market, as in Mexico; possibly some silverware from war-impoverished countries, and possibly some silver coins that have become worth melting because of currency depreciation.

Normal demand for silver includes coinage, the arts and industries, and in India and some other countries ornaments and hoarding.

Demand for new subsidiary and minor coinage in the United States is likely to decline, as our present circulation of nearly $8 per capita should be ample unless there should be serious inflation. Demand in other countries will depend on conditions in them; there will probably be a tendency to meet the demand for small currency with paper or base metal rather than with relatively expensive silver. Any extensive coinage demand by one or more large countries might well strain the silver market, but presumably any country, except the United States, where silver is a political rather than an economic question, would refrain from action that might send the price up.

The domestic demand for industry and the arts has been of the order of 125 million ounces in the war years, and is likely to continue at comparable levels. New families will want table silver, the photographic industry, as in the past, will take large quantities, and many of the new wartime uses in solders, electrical contacts,

bearings, etc., will be applied to the manufacture of civilian goods.

The Indian market is likely to continue isolated from the rest of the world, for there is no dollar exchange available to import more silver, and the price is too high to allow of export.

Silver loaned to war plants (about half of which was for atomic bomb plants) is already counted in Treasury stocks, so that its physical return will not increase the available supply of "free" silver. Lend-Lease silver, however, is returnable in kind. To some extent borrowers may be able to return some of the actual silver borrowed or its equivalent, but otherwise the transactions provide a potential demand for considerably more than a year's normal production or many years' normal surplus of production over demand. If this return in kind is insisted upon, it will be a bullish factor for several years. Lend-Lease repurchases, however, are not restricted to domestic metal.

The future of silver is therefore dependent on varied factors, but both political and economic forces seem to be upward. On the other hand, any considerable increase above the present price might make it profitable to develop substitutes in some uses and so weaken the long-term position of the metal.

LEAD

Metal remains under Government control. Supply insufficient to meet continuing demand. Price averaged 8.60c. in first half

FELIX E. WORMSER, Secretary, Lead Industries Association, New York

LEAD is in the unenviable position of being one of the few commodities remaining under Government control. After weathering several years of war in ample supply, and pinch-hitting for other metals completely drafted for war, it now finds itself unable to meet the large reconversion demand, whereas its sister domestically mined metals have generally been freed of restrictions and are sufficiently plentiful to be used in reconstruction.

This difficulty arises out of two circumstances: Mine production in the United States has declined sharply, due to labor shortage; and demand remains high because wartime and peacetime uses of the metal are largely the same.

Domestic mine production is estimated at 385,000 short tons, the lowest since 1936, a depression year. This compares with 416,861 in 1944; 453,313 in 1943; 496,289 in 1942; 461,426 in 1941; 457,392 in 1940; 413,979 in 1939; and 647,995 short tons in 1929.

As of interest in connection with the premium price plan, an accompanying table shows the subsidy payments made by the Government to lead and zinc miners to increase or maintain production. The premium price plan operates by Act of Congress until June 30, 1946.

Current world shortage of lead has created an interesting situation, brought about by maintenance of the 6.50c. artificial Government price. Statistics released by the Federal Government show that for the first half of 1945 the price averaged 8.60c. per pound. The average is probably higher today. Demand in Europe is just as strong as here, and, naturally, producers in foreign countries, particularly Mexico, Australia, and Canada, will wish to sell in the most attractive market. They know that the market in Europe is better than 6.50c., and unless some subsidy is paid by this Government, as sole importer, to foreign producers, it is not likely that imports of Mexican and other lead into this country will stay at a rate sufficient to satisfy the requirements of American lead manufacturers.

Unless export controls, moreover, are maintained, it will pay nearly every domestic lead manufacturer to sell his finished product abroad for the higher price. Failure of the Government to alter its present price policy in the light of the changed economic postwar picture will cause sharp adjustments to be made when the War Powers Act of the Administration and the OPA expires.

Direct Payments to Increase or Maintain Production

(Reconstruction Finance Corporation)

Year	Lead	Zinc	Copper
1942	$ 3,267,344	$ 8,839,939	$ 5,061,951
1943	9,426,643	29,367,540	25,209,047
1944	13,586,994	40,923,090	27,089,552
1945	[1]17,500,000	[1]43,000,000	[1]30,000,000

[1]Estimated.

Imports of Lead. In Short Tons

Year	Pig Lead	Ores and Concentrates
1943	244,510	74,120
1944	226,068	93,623
1945[1]—		
Australia	26,300	
Canada	33,300	
Mexico	165,000	
Peru	31,400	
	256,000	62,000

[1]Estimated.

Lead and Zinc Prices Under Premium Price Plan

Lead	
OPA Ceiling	6.50c. per lb. New York
"A" Quota	9.25c. per lb. New York
"B" Quota	12.00c. per lb. New York
Zinc	
OPA Ceiling	8.25c. per lb. St. Louis
"A" Quota	11.00c. per lb. St. Louis
"B" Quota	13.75c. per lb. St. Louis
"C" Quota	16.50c. per lb. St. Louis

Consumption during 1945 is estimated at 1,060,000 tons, which compares with 1,134,167 tons in 1944 and 1,126,000 tons in 1943. During 1940, a peace year, consumption totaled 782,000 tons.

Looking ahead in the immediate postwar years, it is hard to see much diminution in the strong demand for lead from its customary outlets. The present and future strength of the lead position lies in the fact that the four largest uses (out of perhaps 15 important ones)—namely, storage batteries, cable coverings, lead pigments, and tetraethyl lead—alone can account for much more lead than domestic mines can be expected to produce in a year.

Recovery from scrap in the United States has been an important source of metal during wartime and will become more so. About 325,000 tons was thus recovered in 1945. Recovery from scrap has been surprisingly steady over the last four years. Bureau figures are: 325,000 short tons for 1945 (estimated); 331,416 for 1944; 342,094 for 1943; 323,001 for 1942; 397,416 for 1941; 260,346 for 1940; and 241,500 for 1939. In the postwar period the most that can be expected is about 25,000 tons per month.

When we come to imports, the situation looks blue. Lead evidently has broken away from its traditional prewar pattern, whereby domestic mine production and domestic consumption, including scrap, were about in balance. It now appears that substantial quantities of imported lead will be required in peacetime to satisfy the large domestic consumption. Normally, Mexican, Canadian, and Australian pig lead short-circuits this country and goes abroad. One may expect to see part of this foreign tonnage transported to this country in the future.

During 1945, to meet war demands, about 256,000 tons of pig lead was imported into the United States, plus about 62,000 tons in the form of ores and concentrates.

During the war the Combined Raw Materials Board handled the world-wide allocation of available foreign supplies. With the ending of this activity as of Jan. 1, 1946, there will be more or less a free-for-all. Government officials estimate that we shall be permitted to import only about 10,000 tons per month.

Information is now appearing on the refined lead production of other countries. Estimated production figures for seven countries are tabulated.

Stocks of pig lead in Government hands during the war never were unwieldy. They reached a peak of 275,000 tons in March 1943, then gradually declined to a low of 65,000 in May 1945. At the end of 1945 they were 75,000 tons. Under the Government policy to dip into these stocks to assist in reconversion, the stockpile is expected to be 50,000 tons at the end of March 1946.

Foreign Refined Lead Production. In Short Tons

Country	1943[3]	1944[3]	1945
Australia	192,811	156,434	174,554
Canada	224,493	143,757	155,000[1]
Mexico	206,512	193,474	231,000[1]
Peru	47,729	42,824	44,000[1]
Argentina	25,279	23,826	18,000[1]
Spain	38,124	30,000	14,479[2]
Germany	169,200	150,000	[4]

[1]Estimated. [2]First half of 1945. [3]A.B.M.S. [4]Not available.

In conclusion, lead enters the postwar era in strong position. Through force of economic events, assuming free enterprise returns and no price control remains, one may anticipate an intensified worldwide search for more lead, which, eventually, will help to relieve the current shortage. At the same time a probable higher postwar price of lead may be expected to encourage the substitution of other metals and materials for lead and thereby also relieve pressure in the market for more lead.

COPPER

Early postwar demand exceeds expectations. Empty "pipeline" again swells buying movement. Price favors buyer

H. H. WANDERS, Market Editor

IN VIEW OF THE FACT that the European phase of the war ended in May, and Japan collapsed in August, the accounting for 1945 on the movement of copper to fabricating plants was far better than those intimately associated with the industry could have foreseen. The statistics of Copper Institute placed total deliveries of refined copper for the year at 1,517,842 tons, which compares with 1,636,295 tons in 1944 and 1,643,677 tons in the peak year of 1943.

As in prior war years, the United States again was in the comfortable position of being able to import substantial tonnages of copper from areas that otherwise would have been hard pressed for some means of carrying on normal copper-mining operations under war conditions. Purchases of copper from foreign sources were increased early in the year, at which time officials of the War Production Board lifted copper requirements for the first quarter to 457,000 tons. Later returns showed that the fabricating division of the industry actually consumed 490,849 tons of refined copper in the January-March period, marking the highest three-months' period of copper consumption in this country on record. Manpower shortages, rising costs, and a rigid price policy made it impossible to step up production at domestic mines to meet a larger proportion of this tremendous demand. Of the tonnage of copper delivered to consumers during the year, about 45 percent was foreign metal. This contrasts with slightly less than 34 percent in 1944. Though the percentage of foreign copper used in our war effort increased steadily throughout the war period, domestic mines could have produced more copper if control, pricewise and on the labor front, had permitted more freedom of action.

WPB officials, in March 1945, revealed that 80 percent of the copper purchased by the Government from foreign producers was obtained on the basis of 11.75c. per pound, f.a.s. Atlantic ports, and 20 percent at above ceiling prices, resulting in an average of 12.40c. for the

U. S. Copper Statistics
(Copper Institute)
In Tons

	Production		Deliveries
	[1]Crude	Refined	[2]Domestic
1941	1,016,996	1,065,667	1,545,541
1942	1,152,344	7,135,708	1,635,236
1943	1,194,699	1,206,871	1,643,677
1944	1,056,180	1,098,788	1,636,295
1945:			
January	73,754	67,726	145,904
February	67,496	69,950	172,585
March	76,537	76,395	218,488
April	74,392	75,436	161,111
May	74,469	85,319	139,203
June	72,271	74,377	94,031
July	72,855	72,995	88,661
August	68,253	69,127	86,840
September	64,091	45,145	83,478
October	69,322	70,363	104,104
November	65,586	70,218	119,973
December	62,798	66,062	103,464
Totals	841,824	843,113	1,517,842

[1]Mine or smelter production or shipments, and custom intake including scrap. [2]Beginning March, 1941, includes deliveries of foreign copper for domestic consumption.

imported metal. Statistics now available indicate that in the first eleven months of the year a total of 775,716 tons of copper was imported by the United States, chiefly as blister and refined metal. Imports of old copper and scrap in the same period were light.

The pressure on the market began to ease early in April, or almost a month before V-E Day. First cutbacks in the war program occurred in the production of small-arms ammunition. Though demands continued to fall steadily throughout the summer, the downward trend in war production failed to shake the market. Soon after V-J Day was proclaimed in August, interest quickly shifted to reconversion. Controls on consumption were lifted in August. By October consumers were absorbing more than 100,000 tons of copper a month. The decline in the volume of business at no time reached the point where surplus metal had to search long for a buyer.

Stockpile legislation covering surplus materials removed a possible source of serious trouble. Domestic production in the summer and early fall was insufficient to meet this country's immediate postwar requirements, and foreign copper was released by the Government to fill a rather wide gap between total demand and supply of new copper from domestic sources. Soon after the shooting stopped, some domestic producers did feel a little uneasy lest foreign copper be allotted to consumers before domestic production had been disposed of, but this uncertainty was overcome to the satisfaction of all concerned by giving prior consideration to all copper produced domestically in arranging monthly deliveries.

Heavy call for copper by the wire and cable industry absorbed much of the shock of reduced war demands. This buying offset general curtailment at brass mills, and was largely responsible for lifting deliveries from the monthly low for the year of 83,478 tons in September to an average of 109,000 tons a month in the final quarter. Before the year ended the brass mills began to enter the market for copper and the outlook for copper-bearing alloys also was viewed as encouraging.

With civilian needs for copper and copper products enormous, fabricators showed no anxiety over the size of their inventories. There was general agreement on the stability of the price structure, with many holding to the view that costs will rise and that 12c. copper favors the buyer rather than the seller. The cost of producing copper has risen in all parts of the world. After the Premium Price Plan expires on June 30, 1946, production of copper in the United States is likely to drop unless (1) the price is permitted to rise, or (2) costs can be reduced.

The heavy buying movement is expected to continue for some time to come, or at least until the empty "pipelines" for civilian products, plus current demand, can be filled. Exactly when buying of copper in this country will slow down to a pace to match actual consumption is unpredictable.

Resumption of bulk buying by the British Ministry of Supply, and renewal of purchases by the United States Government, though on a reduced scale, announced after the turn of the year, improved the outlook for foreign copper appreciably before 1946 was one month old. In fact, the price structure on foreign copper appeared to be quite firm in all directions.

ZINC

Year of fluctuating demand closes with stocks at all-time high. Consumption of metal reflects transition from war to peace

CHARLES R. INCE, St. Joseph Lead Co., New York

THE YEAR 1945 will probably be considered one of the most unusual ones in the history of the zinc industry. Although production continued throughout the twelve months at a fairly steady level, ranging between 60,000 and 70,000 tons per month, demand ran the gamut from a shortage of supplies in the early part of the year to a condition of relative abundance in the third quarter. Toward the end of the year there were again indications of shortages in certain grades of metal.

These violent fluctuations in the country's requirements were, of course, primarily due to the two-phase termination of the war and the subsequent start of reconversion. Up until V-E Day, in May, the demand, owing to the hastily enlarged munitions program after the reversals of December 1944 on the Western Front, exceeded domestic and imported metal supplies, with the result that stocks of metal declined to around an 18-months' low of 168,000 tons. The subsequent one-front war until V-J Day, in August, reduced requirements to a point where supplies were again in excess, and stocks started to climb at a steadily increasing rate,

which continued through the beginning of reconversion.

The reconversion period apparently was of shorter duration than expected, and consumption mounted steadily starting in September. Nevertheless, due to the continued effect of subsidy payments, supplies remained above requirements, although by a gradually narrowing margin, and stocks of metal in the hands of producers and Government reached an all-time high of more than 255,000 tons on Dec. 1.

Highlighting the year's uncertainties in demand and supply were several occurrences. With the termination of the war, all restrictions on the use of zinc were removed and allocation of the metal was eliminated by revocation of orders M-11 and M-11b. The contracts that Canadian producers had with the British Government for their output of metal expired in August, making available to consumers in the United States large tonnages of electrolytic metal. Metals Reserve Co. stopped purchasing the excess domestic production as of Oct. 31. Notice was given to those smelters that were receiving subsidies for treating Tri-State concentrates that the subsidies would be terminated as of the end of the year, a forerunner of the action that may be taken next June with regard to mine subsidies.

The Prime Western ceiling price paid by consumers continued throughout the year at 8.25c. per pound, St. Louis. Actual prices received by miners varied according to premiums and quotas under the subsidy plan and are averaging, according to latest reports, 10.9c. per pound. Approximately 40 percent of the domestic production was at ceiling prices. These figures show little variation from the previous year. Comparable statistics indicated an average over-all price of 11.09c. per pound with 38 percent of the production at ceiling prices in 1944.

Consumption trends in 1945 reflected the transition from war to a peacetime economy. In the early part of the year, the brass industry, due to heavy munition requirements, was the heaviest consumer of zinc, taking as high as 36,000 tons per month in January and March. From that point its consumption steadily declined, whereas galvanizing, as steel became available, and die casting, which has extensive peacetime application, continued to require more metal. Toward the year's end galvanizing was using approximately 29,000 tons per month and was well on its way to assuming its usual peacetime role as the largest consumer of zinc. Die-casting metal, supplemented by the use of the same alloys for stamping dies, was taking about 10,000 tons a month at latest reports and bids fair to exceed its prewar peak of 125,000 tons per year in the near future.

The question of disposition of Government-owned stockpiles of zinc metal and concentrates continued to concern the producers. At the beginning of the last quarter this stockpile in the form of metal or recoverable zinc was reported to be 736,627 tons. At the year's end, Congress was considering legislation to determine disposition of these and other surpluses. The action taken under such legislation undoubtedly will influence the future trend of the zinc market.

The outlook for zinc contains many uncertain factors which only time can resolve, even though the large backlog of unfilled needs points to a high level of consumption.

Although shipments in the late months of the year declined considerably from the wartime peak, they were still much higher than had been anticipated, despite the depressive effect of strikes and threatened strikes in heavy industries. Demand from galvanizers and die casters were so strong that an unusually high level of consumption could be expected when brass mills had digested their surplus stocks and strikes had been settled. Another favorable factor was the evident intention of Congress to create a strategic-material stockpile, thus immobilizing all or part of the large stocks of zinc metal and concentrates held by the Government.

The likelihood of pressure of foreign offerings on the domestic market was ameliorated by the probability that by the depletion of some important domestic deposits, and expanded requirements, the domestic market can absorb a substantial amount of foreign concentrate production without creating distress. Nevertheless, the tariff reductions on zinc, and the apparent intention to reduce the duty further, can put domestic smelters and miners in a vulnerable position if an oversupply of metal or concentrates develops anywhere in the world.

With so many doubtful elements entering into the picture, a prediction of future zinc prices would be not more than a guess. About all that may be said is that with the removal of premium payments, which eventually will be dropped, the price for zinc may rise above the present wartime ceiling, but it is probable, taking a longer-term view, that the price of zinc, which has advanced out of proportion to that of other non-ferrous metals, will be lower than at present, though not so low as the prewar average.

Table of Production, Shipment and Stocks—1945

(American Zinc Institute)

	*Stock at Beginning	Production	Total	Domestic	Export & Drawback	Total	*Stock End of Period	Unfilled Orders End of Period	Daily Average Prod.
Jan.	237,520	70,492	308,012	89,949	2,504	92,453	215,559	27,546	2,274
Feb.	215,559	64,723	280,282	82,650	205	82,855	197,427	28,055	2,312
Mar.	197,427	71,739	269,166	94,296	198	94,494	174,672	14,917	2,314
Apr.	174,672	68,223	242,895	74,313	43	74,456	168,539	16,318	2,274
May	168,539	69,440	237,979	66,839	133	66,972	171,007	17,423	2,240
June	171,007	66,607	237,614	54,023	454	54,477	183,137	16,666	2,220
July	183,137	65,830	248,967	51,803	106	51,909	197,058	16,656	2,124
Aug.	197,058	64,753	261,811	48,084	171	48,255	213,556	9,211	2,089
Sept.	213,556	61,600	275,156	41,410	471	41,881	233,275	12,518	2,053
Oct.	233,275	65,614	298,889	52,052	1,172	53,224	245,665	14,809	2,117
Nov.	245,665	64,337	310,002	51,326	3,123	54,449	255,553	19,005	2,145
Dec.	255,553	66,104	321,657	61,482	842	62,324	259,333	27,092	2,132
		799,462		768,227	9,422	777,649			

*Does not include Government stocks at other than producers' smelters, amounting to approximately 33,000 tons at the end of the year.

TIN

Controls on use of metal likely to be retained. Stocks low at year's end. What to do with Texas Longhorn smelter a problem

S. D. STRAUSS, Room 1101, Lafayette Building, Washington, D. C.

THE SUCCESSFUL CONCLUSION of the war on V-J Day was looked on by the tin trade as the harbinger of substantial changes in the supply-and-demand situation. So far, however, they have failed to materialize, and the statistics for tin supplies and use in the United States during 1945, when they are finally available, will not differ greatly from what they would have been had the war continued throughout the year.

The United Nations have been at least technically in control of Malaya, Netherlands Indies, Burma, Siam, and Indo-China since early September 1945. These areas normally account for two-thirds or more of the world's new tin production—in the period immediately preceding the war their combined output was in the order of 120,000 to 150,000 long tons of tin a year.

By contrast, the areas of which the tin has been available to the United States since early 1942—chiefly Bolivia, Belgian Congo, Nigeria, and China, with Australia, England, Portugal, and the French Cameroons yielding lesser amounts—have in no single year since the war began produced as much as 100,000 long tons.

The potential supply of tin now having more than doubled overnight, it is not strange that the average user, and certainly the consuming public, expected that controls on use could soon be removed and the metal be made freely available for civilian products.

A Disappointment

But the average user and the consuming public were doomed to disappointment.

First, during the four months between the Japanese collapse and the end of 1945, the only tin from the Far East actually to reach the United States was a small windfall stock found when we retook the Philippines in the spring, plus small shipments from China, which had been an irregular supplier during the war.

Table I—Texas City Tin Smelter 1945 Operations

	Long Tons
Stock of Longhorn tin, Jan. 1, 1945	22,515
Production, Jan. 1-Nov. 30, 1945	36,916
Total available, through Nov. 30, 1945	59,431
Shipments, Jan. 1-Nov. 30, 1945	38,466
Stock of Longhorn tin, Nov. 30, 1945	20,965

The military forces occupying the Asiatic mainland and the East Indies supplied information indicating the existence of certain stocks of tin metal and concentrates, but the information was confusing and contradictory. Evidently such stocks do exist and may amount to as much as 25,000 or 30,000 tons of tin (including content of ore) in the aggregate. Machinery for shipping them to consuming countries, however, has been slow to operate—possibly due to local lack of technical personnel.

Second, apart from windfall stocks, as this is written, the volume of current production in the areas formerly occupied by Japan is so small as to be negligible, probably not more than 5 percent of the 120,000 to 150,000 tons of tin mentioned. The Japanese had more tin than they needed and no special reason to foster continued production.

Slow Restoration Expected

Surveys have indicated that most of the dredging equipment is still afloat but needs reconditioning. Probably more than half of the smelting capacity is available. Power equipment has been dismantled and will have to be replaced in many areas. Organizations will have to be reassembled. This promises to be difficult, because many of the Chinese skilled workers, who were the core of the Far Eastern tin industry's trained labor supply, have scattered or perished. The United States members of the tin mission who returned shortly before the year-end have indicated that food and transport shortages may prove the most trying aspects of the situation. Predictions regarding the speed at which output can be restored vary widely. It appears conservative to estimate that by the end of 1946, production will not exceed one-third of the normal range of 120,000 to 150,000 tons a year.

A third factor that makes it necessary to continue controls on tin is the likelihood that Bolivia, the Belgian Congo, Nigeria, and the other areas under United Nations control during the war, may not continue to produce at the wartime scale. Their tin-mining industries operated at forced draft, under the incentive of high prices and military necessity. Development work and even maintenance were sacrificed for immediate production. Operating costs rose sharply and the burden of government taxation and exchange control, particularly in Bolivia, has diminished the interest of private capital in new risk ventures. It is probable that output in these areas in 1946 may be 5 to 10 percent lower than in 1945.

A fourth factor is the diminution of stocks to the point where further substantial shrinkage may be serious. Throughout the war the United Nations lived on the fat accumulated by the United States in the form of stocks of metal and ore built up prior to Pearl Harbor. Today private consumers (who always carried a substantial reserve of tin) have barely enough for working stocks. The Government's stock of metal is as large as it is only because the Texas City smelter has been producing more tin than it has received in the form of ores and concentrates (see Table II).

Yet all these factors on the supply side could be ignored if the demand for tin without restriction would be limited to, say 55,000 or 60,000 tons a year in the United States. In the past this country has consumed 40 to 50 percent of the world output, but the devastation of much of Europe's heavy industry indicates that for the first few years after the war our percentage of

Table II—Metals Reserve Stocks of Tin, Metal and Ore

	Jan. 1, 1945	Nov. 30, 1945
Longhorn tin	22,515	20,965
Imported tin metal	5,676	3,450
Tin content of ore	39,993*	34,616*
Totals	68,184	59,031

*Includes material in process in the smelter.

the world consumption may be expected to rise to between 60 and 70 percent.

Consequently, if tin consumption in this country continued at the rate to which it was artificially restricted during the war, there would be no problem. But the evidence is strong that, without control, consumption here, for a year at least, would run at a rate of over 100,000 tons of new tin alone and may in fact be equivalent to the probable world output of new tin in 1946. As a result the outlook for lifting tin controls is not bright and will not materially improve until supplies begin to arrive from the East in substantial quantities.

Longhorn Smelter Drew on Stocks

As Table I shows, production of tin metal from the Government-owned smelter at Texas City during 1945 was more than 40,000 long tons, the largest annual tonnage since the plant started in April, 1942. But in doing so, it had to reduce its stocks of raw materials substantially.

With material now under contract, afloat, or actually on hand, the plant has an assured ore supply through the fall of 1947. Hearings before the Senate Mead committee, in September 1945, indicated an interest on the part of Congress in continued operation, but obviously this will not be possible unless steps are taken to obtain additional ore supplies. Such purchases would be permitted under the stockpiling bill now being considered, but unless the bill is broadened to permit resale of tin recovered from concentrates purchased by the Government, the smelter would be in position of buying and smelting ores for stockpile only. Since it is not certain that the tin situation by the fall of 1947 will be sufficiently easy to take care of all requirements and permit diversion of tin to stockpile at the rate of 40,000 tons annually, Congress may be asked for legislation enabling purchase of tin ore for the smelter without restriction on resale of the resultant tin.

Who Should Operate Texas Plant?

Whether the smelter should eventually be operated by private industry; for Government account; or under a dual arrangement calling for Government purchase of ore and private smelting of Government ore on toll, is a problem on which there is much discussion but little in the way of comparative factual data on which to base a decision. The smelter has been operating with war-inflated costs on a feed about 80 percent of which (by tin content) has been Bolivian ore. No other smelter has had comparable conditions, and consequently the competitive position of the Government tin plant is uncertain.

Yet if a decision on ore purchases is delayed, there may be no ore available to purchase. With this in mind the Government agencies concerned have begun informal conversations with the Dutch, Bolivians, and others regarding continuing ore supplies, subject to Congressional authorization.

The ceiling price of tin established by OPA was unchanged during 1945. Straits tin continued to be held to a maximum of 52c. a pound at U. S. points of import, with standard discounts for lower qualities. No tin being available at the equivalent price in accessible producing areas, all imports were obtained through Government purchase.

Principal contractual arrangements were the contract with Bolivian producers (other than Patiño) for their entire production of concentrates and a contract with the sales agent of the Belgian Congo producers covering metal and concentrates.

Bolivian Contract Extended

The former, negotiated in 1940, expired as of June 30, 1945, but was extended for another year, under arrangements which called for a gradually declining price. Nevertheless, the price in the final quarter of the contract year will still be substantially over the ceiling.

The contract with the Belgian Congo producers will expire as of June 30, 1946, also. The Belgians have taken advantage of certain options to divert some metal to Belgium, but the great bulk of the Congo output of both tin and concentrates has come to the United States.

In addition the United States received 7,500 tons of tin in Patiño concentrates from Bolivia during 1945, under allocation of the Combined Raw Materials Board, which has been responsible for controlling the flow of tin and other raw materials to the United States during the war. It is understood, however, that in 1946 the entire Patiño output will revert to Great Britain, where it is smelted in the plants of Williams, Harvey & Co., in which the Patiño interests are stockholders. In place of these concentrates, the United States may receive some 5,000 tons of English tin metal.

Lesser Shippers

Lesser quantities of tin received in the United States during 1945 came from China (under the long-term contract made early in 1941) and from the French Cameroons and Mexico. The entire Nigerian output went to Great Britain.

The figures for tin ore given in Table II cannot be considered as of material available for allocation, as they include an amount which is at all times in process in the plant (roughly two months' production) and there is a need for a sizable stock of the various grades of material used, to keep plants running.

The spread between total consumption and consumption of primary metal, indicated in Table III, is accounted for by tin recovered from secondary sources, which has been relatively constant at between 25,000 and 30,000 tons annually.

Table III—U. S. Consumption of Tin, Long Tons

	Total Consumption	Consumption of Primary Metal
1941	135,789	107,551
1942	86,096	56,862
1943	81,840	53,137
1944	90,352	61,926
1945 (Estimated)	95,000	65,000

E & M J Annual Average Metal Prices 1897-1945

Year	Copper (a) Electrolytic, Refinery	Tin, (b) New York	Lead Common, New York	Silver, New York	Zinc, Prime Western (d) E. St. Louis
1897	11.29	13.67	3.580	59.790	4.120
1898	12.03	15.70	3.780	58.260	4.570
1899	16.67	25.12	4.470	59.580	5.750
1900	16.19	29.90	4.370	61.330	4.390
1901	16.11	16.74	4.330	58.950	4.070
1902	11.626	26.79	4.069	52.160	4.840
1903	13.235	28.09	4.237	53.570	5.191
1904	12.823	27.99	4.309	57.221	4.931
1905	15.590	31.358	4.707	60.352	5.730
1906	19.278	39.819	5.657	66.791	6.048
1907	20.004	38.166	5.325	65.237	5.812
1908	13.208	29.465	4.200	52.864	4.578
1909	12.982	29.725	4.273	51.502	5.352
1910	12.738	34.123	4.446	53.486	5.370
1911	12.376	42.281	4.420	53.340	5.608
1912	16.341	46.096	4.471	60.835	6.799
1913	15.269	44.252	4.370	59.791	5.504
1914	13.602	34.301 (c)	3.862	54.811	5.061
1915	17.273	38.590	4.673	49.684	13.054
1916	27.202	43.480	6.858	65.661	12.634
1917	27.180	61.802	8.787	81.417	8.813
1918	24.628	88.750	7.413	96.772	7.890
1919	18.691	63.328	5.759	111.122	6.988
1920	17.456	48.273	7.957	100.900	7.671
1921	12.502	29.916	4.545	62.654	4.655
1922	13.382	32.554	5.734	67.528	5.716
1923	14.421	42.664	7.267	64.873	6.607
1924	13.024	50.176	8.097	66.781	6.344
1925	14.042	57.893	9.020	69.065	7.622
1926	13.795	65.285	8.417	62.107	7.337
1927	12.920	64.353	6.755	56.370	6.242
1928	14.570	50.427	6.305	58.176	6.027
1929	18.107	45.155	6.833	52.993	6.512
1930	12.982	31.694	5.517	38.154	4.556
1931	8.116	24.467	4.243	28.700	3.640
1932	5.555	22.017	3.180	27.892	2.876
1933	7.025	39.110	3.869	34.727	4.029
1934	8.428	52.191	3.860	47.973 (e)	4.158
1935	8.649	50.420	4.065	64.273 (e)	4.328
1936	9.474	46.441	4.710	45.087 (e)	4.901
1937	13.167	54.337	6.009	44.883 (e)	6.519
1938	10.000	42.301	4.739	43.225 (e)	4.610
1939	10.965	50.323	5.053	39.082 (e)	5.110
1940	11.296	49.827	5.179	34.773 (e)	6.335
1941	11.797	52.018	5.793	34.783 (e)	7.474
1942	11.775	52.000	6.481	38.333 (e)	8.250
1943	11.775	52.000	6.500	44.750 (e)	8.250
1944	11.775	52.000	6.500	44.750 (e)	8.250
1945	11.775	52.000	6.500	51.928 (e)	8.250

(a) Lake copper 1897-98; domestic copper since 1932. (b) 99 percent tin, 1898 to 1920, inclusive; Straits quality tin thereafter. (c) Average for eleven months. (d) New York zinc 1898 to 1902, inclusive. (e) Other than newly mined domestic. Prices in cents per pound, except those for silver, which are in cents per troy ounce.

Domestic and Foreign Procurement of Critical Minerals, 1942-44

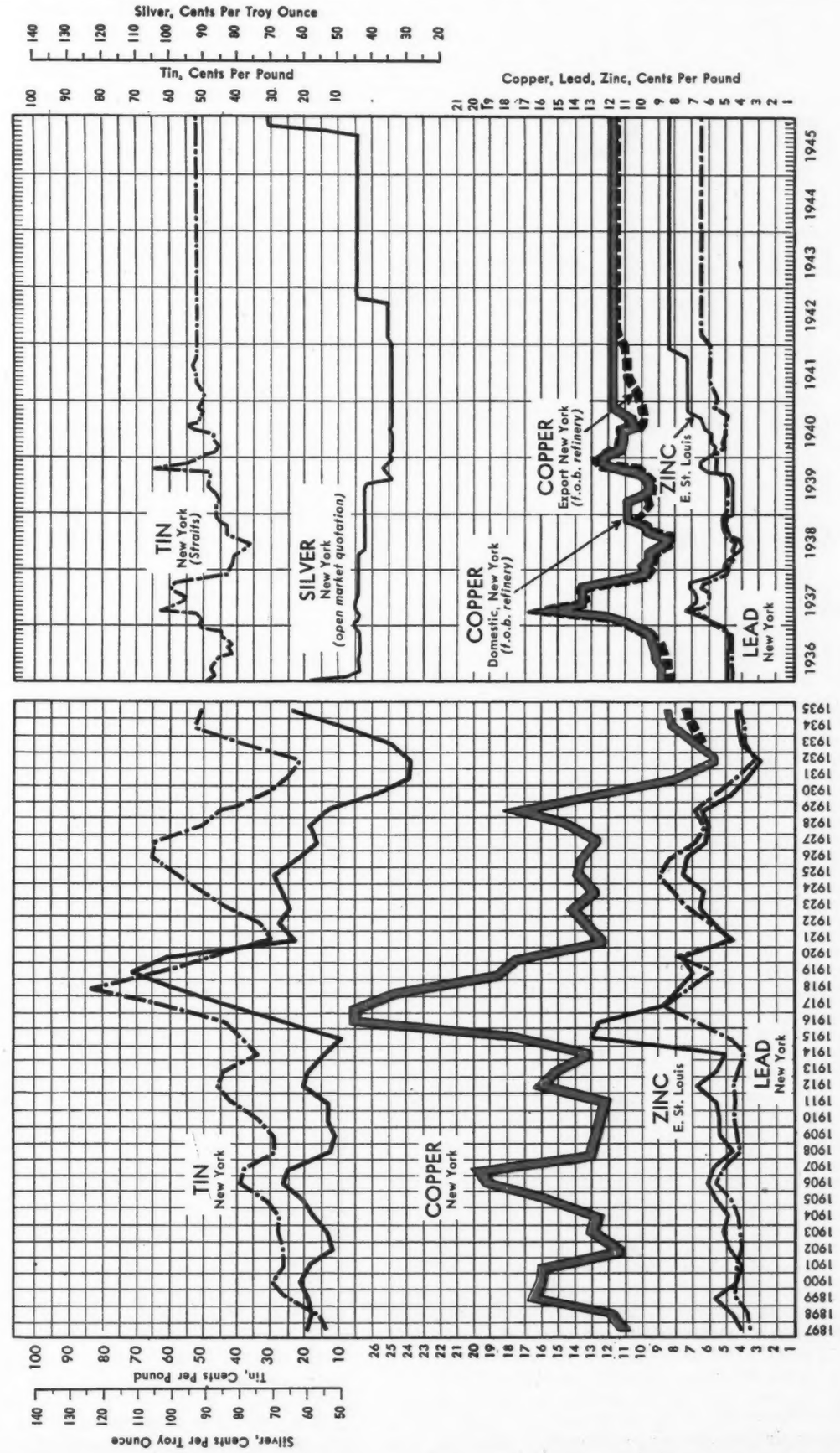
At a hearing on Oct. 30, 1945, on proposed stockpile legislation before the Subcommittee on Surplus Property of the Committee on Military Affairs, United States Senate, Dr. Alan M. Bateman, who directed procurement of foreign metals and minerals for the war program, presented the following data on supplies obtained in 1942, 1943, and 1944 from domestic and foreign sources:

	1942	1943	1944	Total
Antimony (short tons):				
Domestic	4,301	4,963	4,719	13,982
Foreign	22,107	29,803	16,529	68,439
Percent foreign	83.8	85.6	77.8	83.2
Asbestos (short tons):				
Domestic	0	0	0	0
Foreign	48,475	63,891	41,423	153,789
Percent foreign	100	100	100	100
Beryl (short tons):				
Domestic	269	356	388	1,013
Foreign	2,050	4,840	3,115	10,005
Percent foreign	88.4	93.3	98	90.6
Chromium ores and concentrates (short tons):				
Domestic	101,000	143,000	40,000	284,000
Foreign	875,000	829,000	700,500	2,404,000
Percent foreign	89.6	85.4	94.6	89.6
Cobalt (pounds):[1]				
Domestic	735,000	732,000	828,000	2,295,000
Foreign	4,368,000	5,636,000	3,798,000	13,802,000
Percent foreign	85.6	88.4	82.3	85.6
Copper (short tons):[2]				
Domestic	1,081,000	1,123,000	1,039,000	3,243,000
Foreign	646,000	616,000	700,000	1,960,000
Percent foreign	37.4	35.4	40.3	37.6
Corundum ores (pounds):				
Domestic	0	0	0	0
Foreign	10,198,000	12,320,000	12,824,000	35,342,000
Percent foreign	100	100	100	100
Diamonds (carats):				
Domestic	0	0	0	0
Foreign	11,481,000	12,921,000	13,559,000	37,961,000
Percent foreign	100	100	100	100
Graphite (short tons):				
Domestic	0	0	0	0
Foreign	6,719	4,138	5,182	16,039
Percent foreign	100	100	100	100
Lead (short tons):[3]				
Domestic	540,000	419,100	396,600	1,355,700
Foreign	434,000	318,600	319,700	1,072,300
Percent foreign	44.6	43.2	44.7	44.2
Manganese (long tons):[4]				
Domestic	173,000	205,000	217,000	595,000
Foreign	1,186,000	1,481,000	1,250,000	3,495,000
Percent foreign	87.4	86.2	82.6	85.5
Mercury (flasks of 76 pounds):				
Domestic	51,100	53,300	37,819	141,700
Foreign	39,971	48,006	19,819	107,793
Percent foreign	43.9	47.4	34.7	43.2
Mica (pounds):				
Domestic	[5]93,000	179,300	149,600	421,900
Foreign	[5]919,000	1,012,300	1,130,300	3,061,600
Percent foreign	[5]92.0	85	88.4	88
Nickel (pounds):				
Domestic	0	0	0	0
Foreign	192,260,000	208,432,000	195,900,000	596,601,000
Percent foreign	100	100	100	100
Quartz (pounds):				
Domestic	([6])	7,466	3,934	11,400
Foreign	([6])	1,867,137	1,657,087	3,524,224
Percent foreign	([6])	99+	99+	99+
Tantalum ores (pounds):				
Domestic	200	9,411	7,204	16,815
Foreign	567,494	643,080	842,324	2,054,704
Percent foreign	99.9	98.6	99	99
Tin (long tons):				
Domestic	6	8	1	15
Foreign	55,854	37,805	49,889	143,548
Percent foreign	100	100	100	100
Tungsten (pounds):				
Domestic	9,041,000	11,463,000	[7]11,000,000	31,504,000
Foreign	12,684,000	18,581,000	21,725,000	49,465,000
Percent foreign	58.4	61.8	62.2	61.1
Vanadium (pounds):				
Domestic	3,329,000	4,190,000	2,168,000	9,687,000
Foreign	1,932,000	1,588,000	1,126,000	4,646,000
Percent foreign	36.7	27.5	34.2	32.4
Zinc (short tons):[8]				
Domestic	768,000	744,200	712,700	2,224,900
Foreign	340,500	514,400	422,800	1,236,700
Percent foreign	31.3	40.9	37.3	36.7

[1]Contained cobalt. [2]New primary. [3]Combined Raw Materials Board figures. [4]35 percent and over—all grades. [5]April to December, inclusive. [6]Not available. [7]November-December estimated. [8]Recoverable metal in ores and concentrates.

E & M J METAL PRICES 1897-1945

(Annual averages 1897-1935—Monthly averages 1936-1945)



MINOR METALS

V-J Day sees lessened use for most of group, titanium being exception. Mercury unique in wide price fluctuation under ceiling

ECONOMICS AND STATISTICS BRANCH,
U. S. Bureau of Mines

THE WAR'S COURSE, its abrupt termination, and the retarded transition to peacetime industrial activity were clearly shown in the trends exhibited by most of the minor metals.

In general, consumption of several was keyed closely to military requirements, with subordinate quantities available for essential civilian needs. In the first half year, use remained at a high level, dropping sharply from V-J Day because of industrial inability to consume supplies that became available with lifting or modification of wartime use-controls. On the whole, the year's consumption of the commodities was well above that just before the war.

Domestic production for most of these metals held up well, though below peaks reached in 1943 and 1944. Declines were due partly to exhaustion of accumulations of residues and to cessation of marginal production, emphasized by withdrawal of Government support in the form of high prices. This country is not self-sufficient in any of these metals. As sea lanes became safe, imports rose rapidly and prewar suppliers appear to be resuming shipments while certain less important wartime shippers were withdrawing from the domestic market.

Titanium was a striking exception to the general pattern, in which new records were set up. This may be ascribed to the large pent-up demand for titanium pigments, which are essentially identical for war or peace application and therefore required no plant modification for their production. Only moderate, if any, price changes were noted except in mercury.

All the minor metals (titanium as rutile only) were subject to disposal under the Surplus Property Act and subsequent regulations. The War Production Board and its successor, Civilian Production Administration, set aside portions of Government-purchased stocks of critical materials to speed reconversion. Balances have been or may be declared surplus and automatically become parts of the permanent Government stockpile. The Surplus Property Board has recently held there is no maximum limit to the quantities transferable to stockpile even if they exceed the maximum set up by the Army and Navy Munitions Board as required by the Act. The expiration of the mandatory stockpiling features of the Act early in 1946 has led many to anticipate that any undeclared surpluses might be dumped on the market. However, a new act that amends the Strategic Materials Act of 1939 passed the Senate on Dec. 20, 1945, and was referred to the House Committee on Military Affairs. Early action on it is expected to follow. Under its terms, eventually unwanted materials may be disposed of after a waiting period.

CADMIUM

THOMAS P. WOOTTON

Cadmium remained on the critical list throughout 1945. Military demand was the dominant factor in its distribution, but industrial needs for reconversion became evident. Domestic production of primary cadmium will be about 10 percent below the 8,780,000-lb. peak of 1944. Output of secondary metal, usually inconsequential, dropped about 40 percent.

Despite fluctuations in monthly deliveries, the average for 9 months was nearly at the high 1944 rate. Control over distribution continued until Aug. 20, when WPB revoked General Preference Order M-65. Inventory control, however, was maintained under Priorities Regulation 32 until November, when cadmium inventories were limited to 45 days' requirements or a minimum working inventory, whichever was smaller.

Government stocks on Oct. 31 that totaled nearly 1,250,000 lb. were slightly higher than on Jan. 1.

The ceiling price remained 90c. a pound for commercial sticks and 95 for patented shapes.

MERCURY

HELENA M. MEYER

Consumption of mercury in the United States when 1945 began appeared headed for a new record and for even greater heights in 1946, due to the heavy requirements for the new dry-cell battery program. The promise for 1945 was fulfilled, but the end of hostilities in Germany, followed by the collapse of Japanese resistance a few months later, quickly reversed the outlook, so that consumption of mercury in 1946 not only will not equal the record of about 65,000 flasks for 1945 but probably will sink to a level not greatly exceeding prewar rates. The uptrend in consumption at the beginning of 1945 continued through May, when a new high monthly record of 8,900 flasks was established. Total consumption dropped in June, but the quantity used for batteries continued to rise. War contracts for the new-type batteries were cancelled following the termination of hostilities with Japan, and consumption dropped to 5,300 flasks in August. In the final quarter of the year the monthly rate had fallen to probably less than 3,000 flasks, or to less than that for any year since 1940.

The sharply increased requirements for mercury in 1945 were met largely by expanded imports. Receipts from abroad reached the unprecedented levels of 10,963 flasks in April and 19,504 flasks in July, the latter figure more nearly resembling a prewar annual total than a monthly one. Following the cancellation of battery contracts, there was a noteworthy drop in imports, but in the final quarter of the year a large quantity, scheduled for Government stockpiling, was brought into the coun-

try. Total imports for 1945 are not yet known, but the quantity received in the first 9 months of the year (52,329 flasks) exceeded that for any previous calendar year.

Mercury mines in the United States probably produced slightly more than 30,000 flasks in 1945, or 20 percent less than in 1944 and over 40 percent less than in 1943. In the last quarter, moreover, the monthly production rate was well below the prewar average.

Stocks of mercury were undoubtedly at record levels late in 1945. Industry inventories, including some metal destined for Government stockpiling, totaled 40,000 flasks at the end of October, when the Office of Metals Reserve held 63,638 flasks. On Oct. 31, 1944, the Procurement Division of the Treasury Department had 20,010 flasks in stockpile. Later figures are not available.

The price began to rise in the latter part of 1944 under the influence of the new battery program. In July of that year the average quoted price was less than $101 a flask. The peak of the upswing was reached in February, 1945, when the monthly quotation was nearly $166 a flask. Availability of large quantities in Spain, the prospect of obtaining large supplies therefrom, and the actual receipts of supplies ample for the battery program, caused a collapse in quotations which reached a low point of $96 a flask in September. The removal, through Government purchase, of surplus mercury stocks from the market set the stage for an upward reaction in prices in the final quarter of 1945, and early December prices ranged as high as $110 a flask. In fluctuating widely in 1944 and 1945, beneath Office of Price Administration ceilings, mercury was unique among commodities that were subject to price limitations. Mercury ceiling price restrictions were suspended late in August.

At the beginning of 1945 the Government faced the need to release mercury from the stockpile to take care of emergency war needs for the metal. By the third quarter of the year, with Germany and Japan conquered, the situation was reversed, and the Government was stockpiling the metal.

BERYLLIUM

C. E. NIGHMAN

Use of beryllium in 1944 dropped about one-quarter below the 1943 high and continued the decline in 1945. Last year's consumption is likely to be 15 percent below that of 1944 but about five times that of the best of the prewar years.

Residual use controls were lifted May 29, 1945, with revocation of WPB's General Preference Order M-160. The widespread war uses of the alloys, as well as that of the oxide in fluorescent lamps and as a super-refractory, are adaptable to peace time. In the past, growth in the industry was slow, largely because of the apparent scarcity of the raw material and because the high price of the master alloy tended to limit its competitive field. The last-named factor still exists, but wartime experience seems to indicate that a high price for the ore will bring out sufficient supply and that with a high production rate the price of the master alloy can be maintained. This has seemingly overcome considerable of the reluctance of fabricators to employ this relatively new metal.

Domestic beryl production will probably not exceed 100 tons in 1945. This followed the decline in demand but especially the withdrawal of the price support afforded by MRC. Consummation of virtually all the Government's foreign purchase contracts also sharply affected over-all supply. In the first nine months imports dropped to 1,148 short tons, compared with 3,115 tons in 1944. Brazil remained the primary supplier, with India, as in 1944, in second place. Producers' and suppliers' ore stocks at the end of September were less than half those on Jan. 1, 1945. Metals Reserve stocks, including in-transit material, dropped from 5,358 tons on Jan. 1 to 4,865 tons on Sept. 30 and probably were about 4,500 tons at the end of 1945.

Metals Reserve's last beryl-buying price had been $14.50 a short-ton unit for 8 percent minimum BeO content. That price continued to be quoted by trade journals until mid-June, 1945. Thereafter it was quoted at $9 to $10, or roughly three to four times the prewar price. The master alloy quoted, unchanged, during the year at $15 per pound contained beryllium.

PLATINUM METALS

HUBERT W. DAVIS

An outstanding feature of the platinum industry in 1945 was the revocation by WPB on Aug. 20 of Order M-162, which since Oct. 31, 1942, had prohibited use of platinum and platinum alloys in new jewelry. This was followed by a demand for platinum by the jewelry trade which quickly assumed boom proportions. As a result, sufficient metal was not available. Restrictions on use of rhodium and osmium were also removed on Aug. 20. Limitations on use of iridium and palladium had been removed previously. During the war, ruthenium was the only metal of the platinum group that escaped usage control entirely. Maximum prices, established by OPA, Feb. 1, 1943, remained in effect for all platinum metals. However, despite a ceiling price of $165 an ounce for iridium, it was quoted at $120 an ounce.

Refining of platinum proceeded at about the same rate in 1945 as in 1944, when 227,216 oz. was refined. Refining, however, did not equal consumption, which was substantially larger than in 1944. The deficiency was met by release of Government stocks, by imports, and by withdrawals from refiners' and dealers' inventories. In the first 9 months, consumption (as measured by sales) of platinum increased 36 percent over the corresponding period in 1944. The gain was due chiefly to larger sales to the chemical industry, which replaced the electrical industry as the chief outlet. During the last three months of 1945, demand by the two industries dropped phenomenally as a result of the end of the war, but this loss was partly offset by a boom demand by the jewelry trade. During the 10 months January-October, 1945, imports of refined platinum were 66,849 oz., of which 66,748 was supplied by U.S.S.R. Exports were 5,420 oz.

Refining of palladium was at a somewhat higher rate than in 1944, but substantially less than requirements, which in the first 9 months of 1945 were 25 percent greater than in the same period of 1944. There was no supply problem, however, because stocks of palladium were large. During the first 8 months the jewelry trade was the chief consumer, but with removal of the restriction on the use of platinum, there was a decided swing

from palladium to platinum for fine jewelry. Sales of palladium to the electrical industry in 1945 were much larger than in 1944, but those for dental purposes were about the same. Imports of refined palladium during the 10 months January-October, 1945, were 117,870 oz., of which 107,151 oz. was from Canada, 9,966 from U.S.S.R., and 753 that was brought in from the United Kingdom.

Both refining and consumption of the other platinum metals—iridium, rhodium, osmium, and ruthenium—were comparatively small. Iridium, like platinum, was in demand by the jewelry trade after Aug. 20, but this greater requirement was offset by a lessened usage of ruthenium in jewelry. Imports of iridium, osmium, rhodium, and ruthenium were 4,089; 800; 3,767; and 7,786 oz. respectively, during the 10 months January-October, 1945. Of these imports, Canada supplied 2,348 oz. of iridium, 2,367 of rhodium, and 5,386 of ruthenium; the United Kingdom 714 of iridium, all of the osmium, 1,400 oz. of rhodium, and 2,400 of ruthenium; and U.S.S.R. 1,027 of iridium.

Stocks of refined platinum held by refiners, dealers, and importers dropped substantially during 1945, but those of palladium increased. Stocks of refined platinum metals held by Metals Reserve on Oct. 31 comprised 55,166 oz. of platinum, 3,147 of iridium, 161 of rhodium, 185 of osmium, 39 of ruthenium, and 72 of palladium. These metals are stored at the Federal Reserve Bank in New York.

TITANIUM

C. E. NIGHMAN

Unsatisfied demand for titanium pigments continued so strong throughout 1945 that a seasonal trend in ilmenite production was not discernible, and domestic production and consumption reached new highs. As recently as 1939, when imports were at their greatest (286,000 short tons), domestic output was only 14,000 tons. In 1945 the United States produced 300,000 tons, three-quarters of this from National Lead Co.'s titaniferous magnetite property at Tahawus, N. Y. Rutile Mining Co. of Florida (Humphreys Gold Corporation, lessee) maintained its beach sand operations near Jacksonville, and other producers showed a rising production tendency. Rutile output was virtually the same as in 1944, at 7,000 tons.

Imports of ilmenite increased greatly, especially in the first half year, and are expected to be about 225,000 tons for the year. India furnished more than 80 percent of the foreign supply, and Norway reappeared as a source. Rutile entries were the same as in 1944 at 10,000 tons, mostly from Australia. Exports of titanium concentrates, dioxide, and pigments were at a higher rate than in 1944.

No substantial departure from the 1944 use-pattern occurred. Ilmenite consumption will probably reach 375,000 tons, with more than 95 percent for pigments. Requirements exceeded production capacity and distribution was partially controlled on a "preferred order" basis under WPB's General Preference Order M-340 (Miscellaneous Chemicals). A decline of one-third to 10,000 tons in rutile consumption compared with 1944 is anticipated, with a greater percentage drop in alloy use than for welding-rod coatings.

Accession of heavy foreign deliveries and the new record domestic production greatly improved the supply and stock position. At the end of September, industry ilmenite stocks were 284,000 tons, an increase of 70 percent since Jan. 1, 1945, and represented 9 months' supply at the 1945 consumption rate. Industry rutile stocks, however, had risen only 15 per cent to 8,000 tons. In addition the Government held at the end of October 3,569 short tons of rutile but no ilmenite.

The nominal price of ilmenite and rutile remained unchanged throughout 1945, as in 1944. Ilmenite, 60 percent TiO_2, was quoted at $28 to $30 a long ton f.o.b. Atlantic seaboard, and rutile, guaranteed 94 percent TiO_2, was 8c. to 10c. a pound.

BISMUTH

THOMAS P. WOOTTON

Shortly after the Japanese surrender, WPB revoked Conservation Orders M-276 and M-295, thereby lifting all restrictions on civilian consumption of bismuth. The use pattern in the first half of 1945 was as in 1944, but when the war ended a reversion to peacetime uses became apparent. Use in pharmaceuticals, held to approximately one-third of total consumption by conservation orders, increased sharply as demand for light-metal alloys and ammunition solder practically disappeared.

Domestic production dropped about 20 percent because of the labor situation and exhaustion of residues. Strikes in Mexico curtailed the output there of bismuth-bearing lead bullion and flue dust. Reports indicate that Peruvian mine production will show a decline in 1945.

Stocks of metallic bismuth held by the Office of Metals Reserve on Oct. 31 totaled 782,514 lb. The nominal price of $1.25 a pound remained unchanged during the year.

COBALT

HUBERT W. DAVIS

Consumption of cobalt (exclusive of salts and driers) by industrial consumers was 3,158,538 lb. in the first 9 months of 1945, a 3 percent increase over the corresponding period of 1944. Large use in high-speed steel, stellite and stellite-type alloys, ground-coat frit, and pigments was partly offset by smaller usage in magnets. Consumption in the last quarter of 1945 is expected to show substantial decline from the 759,545 lb. of the third quarter. Production and imports of cobalt metal were appreciably greater than requirements in 1945 and stocks increased substantially.

The quantity of cobalt salts and driers used is not known. During the first 9 months there was a 20-percent gain in shipments compared with the same period of 1914.

Consumption of cobalt contained in alloy and ore by refiners and processors was 4,151,637 lb. in the first 9 months, compared with 4,012,330 in the same period of 1944. Supplies of alloy and ore made available in the first 9 months were virtually in balance with consumption. However, as the output of a domestic producer was delivered to the Government stockpile, inventories of alloy and ore held by industrial consumers, refiners, and processors were 25 percent less on Sept. 30 than at the beginning of 1945.

Bethlehem Steel Co., which recovers byproduct cobalt at its Cornwall iron-ore mine in Pennsylvania, and

St. Louis Smelting & Refining Co., which produces cobalt-nickel concentrate near Fredericktown, Mo., were the only producers of commercial cobalt ore in the United States in 1945. Output and shipments were much greater than in 1944. The Bethlehem ore is processed at Wilmington, Del., the output being delivered to the Metals Reserve stockpile.

Imports of cobalt in the first 10 months of 1945 comprised 4,198 short tons of alloy containing 3,615,864 lb. of cobalt, and 1,486 lb. of metal from Belgian Congo; 377 short tons of ore containing 96,314 lb. of cobalt, 40,000 lb. of metal, and 120,672 lb. of oxide containing about 89,200 lb. of cobalt, from Canada; 538,684 lb. of metal from Germany; 465,805 lb. of metal from Belgium; and 500 lb. of metal that came from the United Kingdom.

Exports were insignificant; during the first 10 months of 1945 they comprised 1,143 lb. of metal and alloys, 31,730 lb. of salts and compounds, and 50 lb. of ore and concentrates. Exports of oxide were not separately classified in 1945. Exports in 1944 comprised 348,439 lb. of metal and alloys, 40,046 lb. of salts and compounds, 5 lb. of ore and concentrates, together with 92,031 lb. of oxide.

Stocks of cobalt (element) held by the Office of Metals on Oct. 31, 1945, totaled 3,295,421 lb. These comprised 15,698,246 lb. of ore containing 1,771,849 lb. of cobalt, of which 8,172,076 lb. containing 980,649 lb. of cobalt represent cobalt-gold ore from French Morocco; 2,808,000 lb. of Burma speiss containing 172,000 lb. of cobalt; 5,800,000 lb. of cobalt-nickel concentrate and matte containing 755,242 lb. of cobalt; 251,937 lb. of oxide containing 182,330 lb. of cobalt; and 414,000 lb. of metal. Except for 6,102,500 lb. of ore containing 647,320 lb. of cobalt, at Deloro, Ont., all stocks are stored in the United States.

ANTIMONY

THOMAS P. WOOTTON

Toward the close of 1944 military demand for antimony increased and rigid controls were again ordered. On Feb. 3, 1945, WPB General Preference Order M-112 was amended, effective Feb. 10, requiring monthly reports and allocation applications from possessors or consumers of more than 2,240 lb. of antimony contained in any ore, alloy, or compound. This minimum was reduced to 224 lb. on March 14.

Domestic consumption of antimony in making alloys and non-metallic products is expected to be slightly more than the 23,756 short tons used in 1944. Consumption in the first 9 months was 13 percent more than in the corresponding period of 1944, but cancellation of military contracts caused a sharp decline in demand in the last quarter.

Imports of ore continued to come mainly from Bolivia and Mexico, minor quantities coming from Peru, Chile, Honduras, and South Africa. Some antimony metal was imported from Peru and a small shipment of crude metal from China.

Domestic production was about the same as in 1944. The Yellow Pine district of Idaho continued to be the principal source. Output from mines operated mainly for antimony was probably negligible because Metals Reserve stopped buying ore Dec. 31, 1944.

Stocks of industry-owned antimony contained in ores and concentrates were approximately 79 percent greater on Sept. 30 than on Jan. 1, 1945. Office of Metals Reserve stocks of antimony metal and antimony in ores, concentrates, and oxide amounted to about 10,000 short tons as of Oct 31, 1945.

The New York price of antimony metal remained at 15.84c a pound. Ore was quoted at $2.10 to $2.20 a short-ton unit for 50 to 55 percent grade.

ARSENIC

C. E. NIGHMAN

Military use, a large factor in consumption up to the spring of 1944, ceased entirely early in 1945. This decline was accompanied by a second successive year of low boll-weevil infestation, with the result that domestic needs for arsensic were sharply reduced and production and consumption fell almost to prewar levels.

Production of crude and refined arsenic in 1945 will be about 23,500 short tons, compared with the all-time peak of 36,094 short tons in 1944. The production rate well exceeded 2,000 tons a month for the first half year, dipped sharply in July, and continued downward at least through September, when it reached an exceptionally low level of 1,200 tons. A large share of the domestic output in 1944-45 was derived from auxiliary sources utilized during the war. By the end of the year the program of recovery from these raw materials and other accumulations was nearly completed, leaving future output to be obtained as usual from smelters.

Control of arsenic use was effective until Aug. 11, 1945, when Schedule 46 of General Allocation Order M-300 was revoked by WPB. The indicated apparent consumption for 1945 was about 36,000 short tons, or one-sixth less than the actual consumption of 43,500 tons as reported by WPB for 1944, and 30 percent lower than that of the peak year, 1943. Most of the decline in use was attributable to the large carry-over in insecticides, principally in calcium arsenic, and lessened demand. Arsenic requirements for calcium and lead arsenates declined approximately one-quarter below the 1944 needs, but production of paris green remained at the 1944 level. Insecticides accounted for about 70 percent of the use.

Shortage in domestic supply was covered by imports, which for the first 9 months of 1945 at 10,742 short tons were about 2,300 tons over imports in the corresponding 1944 period, and only about 300 tons below that year's total. Mexico furnished about 80 percent and Peru virtually the rest. Exports of white arsenic declined substantially, but those of calcium and lead arsenates for the first three-quarters of 1945 were nearly as great as for the preceding year. Foreign demand for paris green, especially for use in malaria control, was at a high level early in the year. Stocks of white arsenic in the hands of producers and the Government at the end of September were less than half those at the beginning of the year (5,789 short tons). However, the Office of Metals Reserve held as of the same date 3,588 tons in Peru awaiting shipment and about 2,238 tons in as yet untreated domestic ores. At the beginning of 1945 the corresponding quantities were 5,903 and 4,191 tons, respectively. Stocks of calcium and lead arsenates, at the end of September were moderately lower than those of Jan. 1, which were 7,648 and 7,404 tons, respectively. For the fourth consecutive year the quoted price of arsenious oxide remained at 4c. a pound, delivered, in carlots.

FERRO-ALLOYS

Supply situation no longer critical for most of the metals used. Alloy steel production for ten months down about 15 percent

EDWIN K. JENCKES, Mineral Economist,
U. S. Bureau of Mines

WITH FEW EXCEPTIONS, the ferro-alloying elements, or metals, became progressively more available during 1945—some, in fact, to the point of abundance. The few materials that remain critical are pointed out in the respective discussions of the seven individual commodities that follow.

Inasmuch as the steel industry, and in particular the alloy-steel section of it, is the predominant consumer of these elements, its productivity is an acceptable indicator from which the demand for them may be evaluated. American Iron and Steel Institute data show that less steel (both carbon and alloy) was melted in 1945 than in 1944; comparison of the January-August periods in the respective war years shows a 7 percent decline, and the September-November periods reveal a 20 percent drop. Thus an indicated 11 percent decline for steel in 1945 compared with the year 1944 should be paralleled by a similar decline in the consumption of the ferro-alloys.

Inasmuch as September, October, and November were months of war-contract termination and the period when reconversion was largely in the planning stage, it would not do to project this sharply downward trend as a basis for gauging the 1946 outlook for the industry, particularly in view of known large unsatisfied civilian requirements. There are, for example, definite indications that the stainless steels are now in active demand, and it is reasonable to assume that other alloy steels soon will develop a similar upward trend.

During the first 10 months of 1945 alloy-steel production amounted to nearly 12 per cent of all steel melted, a continuation of the ratio set in 1944. In 1943, at the height of military demand for steels, this ratio reached 15 percent. In contrast, during the 10 years before the war alloy steel represented 5 to 8 percent of all steel melted. The return to peacetime uses for steel in 1946 can thus be expected to result in a greater decline in ferro-alloy consumption than will be the case in steel consumption.

In tonnage the production of alloy steel for the ten-month January-October period in 1945 amounted to 7,594,000 short tons, or 85½ percent of the 1944 tonnage for the same period.

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CHROMITE

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Domestic chromite production, after having declined for the second successive year, probably will not exceed 10,000 long tons for 1945, with approximately 35 shippers contributing. Shipments from domestic mines in 1944 amounted to about 41,000 tons.

The Metals Reserve Co. (Office of Metals Reserve) purchasing program for chromite expired Dec. 31, 1945, and has not been removed.

Currently it appears that there is no world shortage of chromite of good metallurgical grade. This material will become available as soon as prices settle down to a level acceptable to both buyer and seller. Elimination of high shipping costs due to war risks since the cessation of hostilities will result in a larger percentage of the price that is paid by the consumer of chromite reaching the producer, although the unit price realized by the latter may be less.

If the market for stainless steel continues at the present apparent level, good-grade metallurgical chromite will continue in demand.

Consumption of chromite in 1945 was slightly below that for 1944 and markedly lower than the all-time high that was reached in 1943, when 861,000 long tons of this commodity was used.

During the first 8 months general imports were at a much higher rate than during 1944, with June, July, and August outstanding. In contrast, September showed the lowest of any month since September, 1944. Industrial stocks plus those held by Metals Reserve have shown only a slight variation.

The published price of $43,50 per long ton f.o.b. cars New York held during 1945 for African or Indian ore of standard quality, 48 percent or over in Cr_2O_3 and of 3 to 1 chrome: iron ratio.

MOLYBDENUM

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The year 1945 was one of decreasing production of concentrates (by 18 percent) and increasing consumption (by about 6 percent) compared to 1944. Consumption of molybdenum products—ferromolybdenum, molybdic oxide, calcium molybdate, etc.—was approximately at 1944 level.

The published price for molybdenite has remained 45c. per pound of MoS_2 in 90 percent concentrates. Up to the end of September exports were about 25 percent of those for 1944. During 1942 stocks of molybdenum concentrates and molybdenum products in hands of producers and consumers had dropped 30 percent as a result of the highest consumption on record. Inventories recovered during 1943 and continued into 1945 at about the level recorded at the end of 1941—a comfortable position.

The WPB regulation requiring the purchase of 3 lb.

of molybdenum-containing high-speed steel for every pound of straight tungsten high-speed steel has been rescinded. The former steel will hold 20 to 30 percent of this market, with straight tungsten types retrieving the balance.

Little is known of the postwar acceptability of the NE analyses as compared to the SAE types of engineering steels, and no satisfactory appraisal of their effect on the market for molydenum products can be made. It seems probable that steel users will specify the higher alloy steels to a great extent, as they used to do before the war.

VANADIUM

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Production of domestic vanadium ore during the first 8 months of 1945 continued at near the 1944 rate but was approximately 40 percent below that for the all-time high year, 1943.

Imports were irregular, and preliminary figures indicate that the quantity received in January-August, inclusive, virtually equalled the imports for the entire twelve months of 1944.

Consumption was virtually the same as for 1944 but was substantially below that in the earlier war years, 1941, 1942, and 1943. Of the ore consumed, 65 to 70 percent was of domestic origin, the remainder being almost entirely from Peru.

Published prices for vanadium ores are nominal and have been quoted at 27½c per pound of V_2O_5 since 1935.

In marked contrast to 1941 and 1942, when the shortage of vanadium was severe, this element has grown relatively plentiful and is freely available.

FERROSILICON

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Ferrosilicon led the ferro-alloys in 1945 in respect to tonnage. Production (including silvery pig iron) decreased 3 percent from 1944 and totaled 680,000 short tons. Shipments from furnaces amounted to 626,000 tons, compared with 686,895 tons in 1944. Production of other silicon alloys, including silicon metal, amounted to 28,000 tons, making the total of all silicon alloys 708,000 short tons.

Shipments of silicon alloys totaled 652,000 tons in the twelve months of 1945, the value being $40,000,000 f.o.b. furnaces.

Consumption of silvery pig iron was estimated at 332,000 tons in 1945. Miscellaneous industries, mainly iron foundries, used 164,000 short tons; manufacturers of steel ingots and steel foundries 150,000 and 18,000 tons, respectively. The bulk of ferrosilicon is used in making steel ingots. These companies used 190,000 tons, or 77 percent of the total.

Ferrosilicon prices were unchanged throughout 1945. They are: 6.65c. to 8.10c. per pound of contained Si, Eastern Zone, 50 percent grade; 8.05c. to 9.05c. 75 percent grade; 11.05c. to 12.30c. 90 to 95 percent grade, according to quantity.

Imports during the first 10 months totaled 22,310 short tons, all coming from Canada. Exports through October 1945 amounted to 832 tons.

MANGANESE

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U. S. Bureau of Mines

The manganese industry in 1945 experienced a period of near-record demand and a sharp decline in output of domestic ore. Ore consumption is estimated at 1,500,000 short tons, compared with 1,593,098 in the record year 1944. An estimated 13 percent decrease in steel output, plus a drop in ferromanganese requirements, resulted in a 12 percent decline in use. Ferromanganese production during 1945 is estimated at 610,000 short tons, compared with 702,632 tons in 1944.

Specifications for purchases of domestic manganese ore by Metals Reserve were made more stringent on Jan. 1, 1945, when the minimum acceptable manganese content was increased from 35 to 42 percent. This action had an immediate adverse effect on domestic mines. Shipments, which had averaged 20,635 tons monthly in 1944, averaged 16,100 tons in 1945 and totaled only 193,000 tons, compared with a tonnage of 247,616 in 1944.

Government ore purchases continued at a high rate, although private purchases again became important in the market in the closing months. Ore stocks held by Metals Reserve, which totaled 1,155,000 short tons on Dec. 31, 1944, had increased to 1,175,000 tons by Oct. 31, 1945. Most of the ore on both dates was held at Baltimore and Pittsburgh.

Imports of ore into the United States totaled 1,202,221 short tons in the first 10 months of 1945. Brazil, Cuba, Gold Coast, and India exported large quantities to the United States. South Africa, which exported only 28,656 tons to the United States in 1944, reentered the market in June 1945 and increased shipments until October, when it became the largest supplier. In April 1945, the U.S.S.R. shipped to the United States the first manganese ore in five years. Its shipments here expanded greatly during the rest of the year and constituted the second-largest supply in October. Grade of ore from U.S.S.R. increased from 40 percent manganese in April to 50 percent in the latter months. Shipments from North Africa, which were heavy during the American offensive there, stopped entirely during 1945.

Ore prices continued virtually unchanged throughout 1945 at 5c. per unit below ceilings of OPA Maximum Price Regulation 248, as amended. Metals Reserve's unit sales prices, effective May 15, 1944, are: 85c. at New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c. at Fontana, Calif., Provo, Utah, and Pueblo, Colo.

Electrolytic manganese continued to expand its applications in ferrous metallurgy. Tests are in progress (some have been completed) at 34 steel plants. The steels in which it has been used in test runs include high-alloy steel of the stainless type, low-alloy steels of

the NE type, plain carbon steels, and ingot iron. At no plant where tests have been made and results reported to the Bureau has it been found impossible or undesirable to use electrolytic in place of ferromanganese so far as the quality of product was concerned. Electrolytic manganese containing 99.9 percent manganese is currently quoted at 34c. per pound in carlots and 38c. per pound in less than carlots.

NICKEL

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Nickel was the least-abundant of the major ferrous alloying elements during World War II and was one of the first metals placed on a restricted use basis. Nevertheless, supplies were adequate to meet all war needs. Primary nickel was consumed at a high rate up to V-E Day, after which demand slackened until V-J Day, when, because of war-contract terminations, there was a substantial decrease in consumption. Restrictions on the use of nickel were removed by the War Production Board on Aug. 20.

Production of nickel in Canada was 198,191,362 lb. in the first 9 months of 1945, compared with 208,752,111 lb. in the corresponding period of 1944. Monthly output ranged from 20,724,884 to 23,893,945 lb. during the first 8 months of 1945 but dropped to 16,506,248 lb. in September.

Imports from Canada during the first 10 months of 1945 comprised 128,250,735 lb. of metallic nickel, 38,716,939 lb. of matte, and 4,875,162 lb. of oxide, which compares with 183,868,941 lb. of metallic nickel, 54,650,757 lb. of matte, and 3,220,615 lb. of oxide during the year 1944.

Receipts of nickel from Canada were supplemented by imports from the United Kingdom, Cuba, and New Caledonia. During the first 10 months the first contributed 5,088,491 lb. of metallic nickel (1,566,039 lb. during 1944); Cuba supplied 27,990,252 lb. of oxide (7,680,367 lb. during 1944); and New Caledonia furnished 11,353,451 lb. of matte (18,121,982 lb. during 1944). The nickel from Cuba is sold in the form of oxide to consumers, whereas the matte from Canada and New Caledonia is refined in the plant at Huntington, W. Va.

Exports consist largely of products manufactured from imported raw materials. During the first 10 months (figures for the full year 1944 are shown in parentheses) they comprised 3,673,601 (8,041,351) lb. of alloys; 1,556,215 (6,892,221) lb. of metallic nickel; 836,962 (477,476) lb. of nickel-chrome electric resistance wire; 193,697 (104,539) lb. of nickel silver, and 255,508 (345,682) lb. of nickel salts and compounds of the metal.

Domestic production of primary nickel was still comparatively small (1,200 short tons).

Stocks of nickel held by Metals Reserve on Oct. 31 comprised 854,000 lb. contained in Burma speiss; 1,131,549 lb. in nickel-cobalt concentrate and matte, 16,997,016 lb. in oxide, 4,045 lb. in hydroxide, 153,983 lb. in Moroccan ore, and 16,479,828 lb. of refined nickel —a total of 35,620,421 lb. of contained nickel. Except for 10,414,754 lb. of refined nickel at Port Colborne, Ont., these stocks are stored in the United States.

TUNGSTEN

HUBERT W. DAVIS, Mineral Economist,
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Decline in tungsten production, which began in May 1944, and was caused by suspension of a number of mines and mills, as well as by reduced rates of output of two of the largest producers, continued almost uninterruptedly through April 1945. Production was at a low monthly rate of about 340 tons (60 percent WO_3) during the first four months. The monthly rate increased substantially, beginning May 1945, averaging 625 tons during the four months June-September and reached 700 tons in August. In October, however, output declined to 480 tons, chiefly because of reduced operations at the chemical treatment plants at Salt Lake City, Utah, and near Bishop, Calif.

Production of primary tungsten concentrates is expected to approximate 5,900 short tons (60 percent WO_3) in 1945, a 42 percent decline from 1944 and 51 percent less than the all-time record established in 1943.

Receipts of imported ore and concentrates also declined substantially in 1945, totaling 7,633 short tons (60 percent WO_3 basis) during the 10 months January-October, compared with 19,164 tons in 1944 and 19,626 tons (an all-time high) in 1943. Bolivia (3,835 tons) and Brazil (2,049 tons) supplied 77 percent of the total imports during the first 10 months of 1945. Exports of ore and concentrates are insignificant.

Consumption of concentrates amounted to 13,600 short tons (60 percent WO_3 basis) during the 10 months January-October 1945, compared with 20,100 and 20,300 tons, respectively, in 1944 and 1943.

Industry stocks of primary concentrates have advanced from 2,045 short tons (60 percent WO_3 basis) on Jan. 1, 1945, to 4,467 tons on Oct. 31, and concurrently stocks of primary concentrates held by Metals Reserve decreased from 22,516 to 20,828 tons. In addition to the primary tungsten concentrates, Metals Reserve held 5,132 tons of secondary concentrates averaging 12.82 percent WO_3, and 88,896 tons of milling ore averaging 0.81 percent WO_3, on Oct. 31. Treasury Procurement Division and U. S. Navy also hold substantial stocks of primary concentrates.

Quotations on ore and concentrates remained steady from January through most of November 1945; foreign ore was quoted at $24 a short-ton unit of WO_3, duty paid, and domestic scheelite of good known analysis, in carlots, delivered, was $24 to $24.50 a unit. During the latter part of November, however, there was some weakening, and foreign concentrates were reported offered at $22 a unit. Ferrotungsten in carlots, delivered, was quoted at $1.90 a pound of tungsten throughout 1945.

Production and consumption of ferrotungsten were 5,953,251 and 5,392,785 lb. (tungsten content), respectively, during the 10 months January-October 1945, compared with 10,264,824 and 8,311,708 lb., respectively, during 1944. Production and consumption of tungsten powder were at a high rate during the first 8 months of 1945, chiefly because of the military tungsten-carbide shellcore program. In fact, during several months both production and consumption of tungsten powder were greater than of ferrotungsten. During the 10 months January-October, production and consumption of powder were 4,570,284 and 3,772,193 lb. (tungsten content), respectively, compared with 4,117,586 and 3,785,534 lb., respectively, during 1944.

Need for Reducing Costs Leads to Better Practice

Let us have a look at the mining industry in its technological aspects, now that the postwar period is here. These are the days that everyone knew were coming, although no one could say just when. While the war was on, there was little time for planning out of the ordinary, and the sudden ending of the conflict found operators still concentrated upon production and labor problems. One fact has stood out in every forecast—postwar operating costs would be all important. How to cut them or hold them down would be problem No. 1. So it is interesting to note what the industry has been doing to better its practice and what are the current trends. It should be borne in mind that great changes are not to be expected in a period of short duration. Some highlights will be mentioned.

The past ten years have seen radical changes in the open-pit mines of the Lake Superior region. Today the pattern for moving ore by truck and conveyor appears to be becoming set. This means that the major problems involved have largely been worked out. Trucks are getting bigger, and the individual conveyors longer and stronger. It is so for open pit ore mining elsewhere. The Iron Country has been a cradle for methods and equipment.

In the pebble phosphate field of Florida, hydraulic mining of the so-called matrix has largely been supplanted by mining with the draglines formerly used for stripping only, with resultant economy in water and labor. Here, too, equipment is getting bigger. The world's largest dragline, with a 25-yd. bucket, as compared with 8 to 10-yd. buckets hitherto used, has just begun to dig.

Underground mining methods are in general receiving more attention in the hope of lowering costs. Engineering principles are taking precedence over hunches and rule-of-thumb procedures. Wider application of block-caving is likely. Questions are being asked as to cheaper ways of mining the underground ores on the Mesabi, this because of declining open-pit reserves. And in the search for ore, a new diamond-drilling technique has recently been developed that gives high recoveries of core in areas where core had been hard to get. Other advances are mentioned in the accompanying review.

Abundant opportunity nevertheless remains for improvement underground. Possible applications for belt and shaker conveyors and for rubber-tired haulage deserve further investigation. Efforts to lower ore transport costs should go on. The rock-burst problem is far from being solved, but has been insufficiently discussed. Mine fires are all too common. The subject of safety in hoisting should have more attention. The advance made in combating dust disease should not be ignored.

At last research in ore dressing appears to be receiving needed recognition, as is witnessed by the growing number of important, well-equipped laboratories that mining companies are providing. This is especially true in respect to iron ore beneficiation, where a spur to action has been provided by shrinking reserves of direct shipping ore. No other class of ores is getting such intensive study in so many different quarters. The concentrator of the future will be controlled automatically to a greater extent than now, and will have a force of better trained men.

Steady improvement in the treatment of the non-metallic or industrial minerals should be noted. An outstanding concentrator is the new feldspar flotation plant recently placed in operation in western North Carolina. This makes the third modern plant to be provided in this area in the last few years for beneficiating non-metallics, the other two being engaged in treating kaolin, or china clay. Despite the progress noted, instances of exceedingly crude and money-wasting practices and equipment are all too common still. Here surely there is still an opportunity for the technically trained man, as has been stated repeatedly in the past.

In the field of metallurgy of the major non-ferrous metals, the light metals have occupied the limelight during the war years. One may hope that the technology involved in the production of the others is not as static as the dearth of information about new developments might indicate. There are of course exceptions.

All in all, the progress that is being made in mining and beneficiation work would be considered fair in normal times. But the times are not normal. An emergency still exists for the mining industry. Efforts must be intensified if this country is to hold its mineral position, with its high wages and relatively advanced depletion.

Mining Practice Marked By Labor-Saving Changes

ROBERT S. LEWIS, Professor of Mining, University of Utah, Salt Lake City

Despite ending of both wars, manpower shortage, plus good production levels for most mineral commodities, force continued attention to use of mechanical devices and more efficient methods of stoping ore

MANPOWER SHORTAGE still plagues the mining industry, despite efforts to train green men, and every effort is being made to compensate for it by using mechanical devices wherever possible. Government agencies have not taken into account that the best and most available ore has been mined, while development and maintenance have lagged behind because of the aforesaid shortage.

More Powerful Trucks

In open-pit mining, truck haulage has been improved by substituting more powerful motors for the original ones, thus minimizing motor trouble. Sprinkling roads and keeping them well graded and free from loose rocks and nails have been found profitable. In operating a unique skipway, the dumping of large rocks from trucks so injured the skips that it was necessary to reinforce them materially. The need of having equipment more strongly built often becomes apparent in mining work when new adaptations of machines are tried. The heavy service to which mining equipment is subjected is not always appreciated.

In the iron-ore pits there is a trend toward use of trucks of larger capacity, these handling more ore with fewer men and at decreased cost. There is likewise a trend toward increased use of belt conveyors for raising ore out of the pits, trucks being employed in the pits to haul the ore to the conveyors. In such elevating conveyor systems the receiving belts are subject to greatest wear at the transfer points, so it is logical to reduce the number of transfers. To this end it is being found worth while to replace several belts with a single belt long enough and of a design strong enough to operate as a single lift. A new dragline installed during the year is said to be the largest yet, with its 25-cu.yd. bucket and 180-ft. boom. Motors develop 1,750 hp. and rated capacity is 20,000 cu.yd. per day.

Heavy 9-in. drills are coming into greater use for blast-hole drilling in open pits. They give increased footage per shift.

An oil-well-type rotary drill, caterpillar-mounted, for drilling 6- to 9-in. holes in quarries and open pits, has been developed.

Numerous changes are being made in underground mine operations. At one mine where square-sets and cut-and-fill methods are used, all dimensions are standardized, such as size of chutes, chute spacing, stope widths, and position of manways and raises. A change is easily made to cut-and-fill mining by simply eliminating the stope sets.

In one form of sublevel stoping the upper benches are carried back ahead of the lower benches, so that the broken ore from the former cascades down over the lower benches, and later falls into draw points, when lower benches are drilled and blasted from underneath. No cleaning of benches is required, and the use of stoper drills makes for faster drilling. Raises from sublevel to sublevel have been used like slots. The ore was broken into the raises and semicircular benches were developed. These were safer to work on.

At another mine, short crosscuts, some 20 ft. long, were driven from and at right angles to the haulage drift. Untimbered finger raises were driven from their ends to the bottom of the sublevel stope as draw points. A mucking machine in the crosscut loaded the train from the side as it remained in the haulage drift, thus eliminating switching and uncoupling cars. Secondary breaking of oversize boulders was successfully done with the loading machine only a few feet away and while trains were being changed. This method could be used in a wide stope by driving a single haulage drift under its center and then driving crosscuts and finger raises on either side of the drift.

In large-scale blasting underground, output per man has been increased 400 percent over that obtained with the former use of large space grizzlies by driving a slide drift at 35 deg. for some 38 ft. back from the mouth of the chute. The 8x12-ft. opening to the bottom of the stope is large enough for boulders too big to roll into the cars. These are blasted from the slide by blasters who enter from small drifts connected to the slide drift below the floor of the stope.

Attention to Caving

Application of the caving system to part of an orebody is receiving more attention. Also the possibility of caving an entire block of ground in which rich veins have already been mined is being studied. The ground remaining is ore of too low a grade to be mined any other way.

In block caving, a hard mineralized pendant in the interior of a stope was broken by horizontal diamond drilling and blasting to prevent the softer and free-running surrounding ore from being drawn off first.

Studies made with plastic vertical plates pierced with tunnels and stopes to scale, confirm the theory of a dome of stress over the stressed

underground area. It is safer to start in the stressed area and drive toward a safe area than to start cautiously in a safe area and drive into the stressed area.

One device, comprising the use of geophones and electronic-magnifying tubes, is stated to show movements of the ground strata on a tape.

To minimize subsidence in deep mines, workings should be held to the smallest practical size. Stoping should be done with a minimum damage to hanging wall and footwall, and permanent support should be supplied as quickly as possible.

Ground Support

In heavy ground a segment steel set has been effective. The arch is in three sections with a semicircular saddle at both ends of each section. Short pieces of round timber, as wedges in the saddles, tighten the set in place. When it takes weight and the timbers are crushed, some of the back is removed to permit it to be replaced, using new wood wedges.

Timber sets in 200-ft. scraper drifts, where the ore runs into the drift through fingers, were frequently damaged. They were advantageously replaced by 10-in. pipe sets. The pipes are filled with round timbers turned to size. The bottom three feet of the pipe posts is often damaged by scrapers, but repairs are easily made by welding on a 4-ft. section of pipe. A steel guide $\frac{5}{8}$x5 in., around the back of the scraper, near the top, aids in reducing wear on timbering.

Copper napthenate is expected to have use in protecting timber against decay. It proved an excellent protective for fabrics in the tropics. Compounded with linseed oil it will not bleed through white paint, and can be painted any color.

Use of jumbos in drifting and in some open stopes is increasing, since much time and effort are saved in setting up. One small jumbo carries two drifter drills, mounted on movable arms hydraulically controlled. The arms can be set in any desired position, thus permitting holes to be drilled within a few inches of the sides of the drift.

In flat-bedded deposits jumbos are coming into use for drilling and blasting high faces, formerly mined by heading-and-bench method. The jumbo, caterpillar-mounted and using electric or compressed-air motor, has two drills with ordinary range of feed, or wagon drill mounting with chain-feed for drilling 8- or 9-ft. holes with one steel or deeper holes with only two steels. The drills are carried on a movable boom controlled by a hoist and cables, so holes can be spotted easily. Bottom holes are drilled first, and the jumbo climbs up the muck pile, after each blast, to drill the higher holes.

Rock-drill design is marked by emphasis on power of blows and cleaning ability, and general ruggedness of design.

A new type of drill bit, having the highest drilling rate of any conventional steel bit tried at one mine, has a 3-32-in. flat edge and a half-inch high shoulder with a short 45-deg. offset below, followed by a 20-deg. taper.

Inductive heating of drill steel seems a possibility. This would give better heating than the usual furnace heating. Also there would be less tendency to oxidize the steel. A certain complex organic substance has recently become abundant and is effective in preventing the formation of sludge on molten salt baths used in steel hardening. It has possibilities as applied to drill steel. This absence of sludge prolongs the life of the bath.

Use of the burn or shatter-cut type of round is increasing. This type of round lends itself to drilling with diamond drills, thus opening the possibility of pulling much deeper rounds, with more material to be handled by mechanical loaders. One mine has tried center holes up to $6\frac{3}{4}$ in. in diameter and has pulled drift rounds 16 ft. in depth.

One mine secured an 8- to $9\frac{3}{4}$-ft. break in a drift round with a burn cut of 6 holes tangent to a 13-in. equilateral triangle centered at the middle of the face. Three holes at the corners were loaded lightly; three larger holes were drilled at the middle of the sides and were unloaded.

Automatic jumbos equipped with rotary drills are in the planning stage.

New Work for Scrapers

Slushing is finding new applications. In one case two storage raises feed ore into a slusher drift 50 ft. long and driven on a 10 percent grade. The main haulageway, at right angles to the drift, is a few feet lower than the drift, so the scraper pulls the ore down the drift and directly into the cars. In another method, ore is unloaded from side-dump cars into a concrete trench some 6 ft. wide and 70 ft. long. The scraper, operating in the trench, pulls the ore to one end, when the ore falls down short chutes into skip pockets.

Full automatic operation of scrapers, under relatively fixed conditions, is employed in some iron mines where the scraper works in a transfer drift, up to 400 ft. long. Less wear on wire rope and on brake and clutch bands results because of the constant performance of the hoist under automatic control. In some mining districts 60-hp. hoists have been used to operate scrapers in tandem, and have moved 220 tons per shift a distance of 900 ft.

A New Slide

One type of small loading slide is pushed against the muck pile instead of being some distance away. Another type, used in timbered drifts, has the tail sheave fastened to a drift cap, so the rear boom of the slide is only long enough to hold the hoist. This arrangement makes a compact unit.

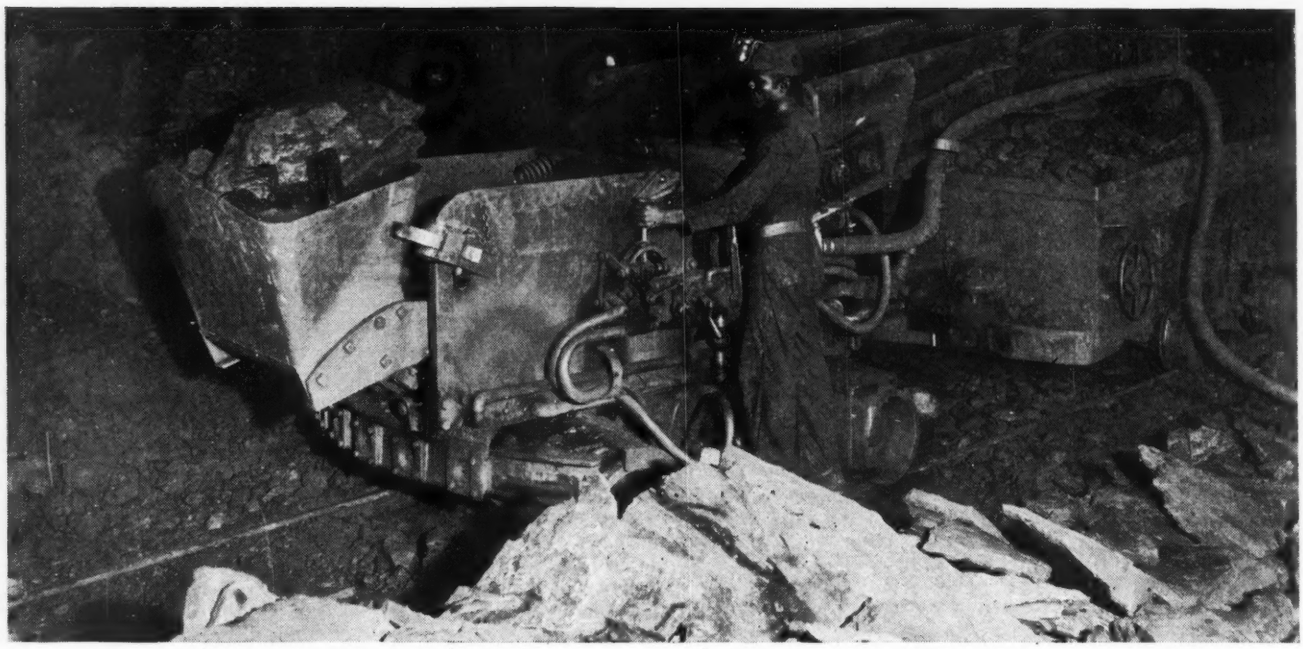
Scrapers mounted on a loading ramp, which runs on a track around the toe, have been used for loading fill material from a waste dump over 100 ft. high. The tail sheave, at the top of the dump, is fastened by a rope to a length of rail embedded in a concrete block in a hole, some 60 ft. back from the edge of the dump. The scraper digs into the lower part of the dump and the upper part falls down. Cars run under the ramp on a track parallel to that on which the ramp moves.

Diamond drilling is being used more and more for drilling holes for blasting, in most cases supplementing the use of rock drills, and mining methods are being adapted to large-scale blasting wherever it is feasible.

One foreign mine abandoned solid diamond-drill bits for 2-in. coring bits in drilling for blasting in sublevel stoping. One type of column-mounted diamond drill has a revolving air motor. The rods turn on the same axis as the motor, thus giving a direct drive, which minimizes vibration and noise. Two ranges of speed, 0 to 1800 r.p.m. and 0 to 3300 r.p.m. are provided.

Improved electric blasting caps have a short rubber plug replacing former combination seals. This design makes for a shorter cap. Plastic leg-wire covering resists abrasion well and can be made in contrasting colors to aid in hooking up circuits.

A small caterpillar-tread dragline



A MUCKING MACHINE AT WORK underground in an iron mine in the Birmingham district in Alabama. Mechanical handling of ore and rock has long been a feature of operations in this area. Here scraping was already highly developed in the early twenties. Today with labor shortage and the prospect of higher costs mechanization is becoming increasingly important.

has been used for sampling shallow placers instead of a churn drill. No roads are needed, and a good panner can estimate the value of the gravel quite closely. A wood pontoon-type of dredge hull was developed during the war because of the shortage of steel. A specially shaped "rock bucket" on a dragline successfully handles large boulders in a placer deposit. A variation in "doodle-bug" washing plants is one running on caterpillar treads on land. A dragline feeds gravel to the plant. Water is supplied to the tables by pipe line.

Shaft Sinking

A new method of shaft sinking in a foreign country utilizes a cage, with a solid steel floor 12 in. thick, weighing 100,000 lb. when equipped with drill sharpeners, air compressors and other sinking equipment. A 36-in. hole is cut in the cage bottom for the passing of men and sinking bucket. The men stay on the cage during blasting, which does not jar the cage severely, and start mucking within a short time.

In clayey, sandy formation, circular shafts have been sunk some 272 ft. by rotary drilling methods, boring a 24-in. pilot hole with a special bit and then reaming to 84 in. The shafts were then lined with a ½-in. thick steel casing and were cemented outside the casing. The two circular compartments were 16 ft. apart at the surface.

In a recently completed six-compartment shaft with concrete walls and steel sets throughout, a 4-in. compressed-air line, a water line, a 6-in. discharge water line, and two ventilating pipes were embedded in the concrete to have the shaft free of pipes during sinking. Sinking and lining were done concurrently.

Diesel lomomotives are being used underground more abroad than in this country. The recent use of a 4½-ton Diesel locomotive in a long tunnel in this country shows a satisfactory performance. At 9c. per gallon the cost for fuel was stated to be 0.08c. per ton-mile.

Block signal systems are being more widely used on main haulage systems, and are effective in promoting more efficient use of single tracks. Electric mine locomotives may run away if the operator falls, leaves his place, or is prevented from getting back to his seat. By equipping the locomotives with an electric switch, operated by a pedal in the cab, the current is shut off the moment the pedal is released, and the locomotive stops.

Boosting the capacity of a shuttle-car battery as much as 25 percent during a shift and without interrupting the operating schedule has been done by installing a resistor on the shuttle car. Plug-in connections are made at each end of the run while loading and unloading.

By setting a repaired electric mine locomotive up on pairs of trunnions, the motors can be operated at full speed and the brakes tested in the shop, without the need of running the locomotive on the track.

Ventilation

Axial flow fans are widely used in mine ventilation. Minor improvement in efficiency might be expected from polishing blades. Drive belts with steel cords are more likely to remain matched. Thermostats on bearings give warning of too great heating, and signals may be used to indicate that the fan has stopped.

In one mine where the rock temperature is about 100 deg. F. at the bottom level, and the rock temperature increases at the rate of 1 deg. F. for each 75 ft., levels are connected by sinking winzes rather than by driving raises. The temperature in a winze is lower than in raises, being 76 to 79 deg. F. In another mine, haulage drifts 12x13 ft. are driven long distances in rock having a temperature up to 96 deg. F. Spun concrete pipe 30 in. in diameter, in half sections 4 ft. long and reinforced with small rods, is used both for carrying water out of the heading and for conveying away the exhaust ventilating air, which is blown to the face through a 22-in. galvanized pipe by a fan of 6,000 c.f.m. capacity. The fan is carried on a saddle on top of the concrete pipe, and is kept at least 50 ft. back from the inner end of the pipe. Near the outer end of

the pipe a galvanized pipe is tapped into the side of the former and a 10,000-c.f.m. fan is used as for exhausting. Thus the one concrete pipe carries the drainage water and the exhaust air. This arrangement will serve 5,000 ft. of drift effectively.

An interesting foreign hoist is a 6,600-volt, 1,950-hp. a.c. hoist. In certain cases an induction-motor hoist is more economical to operate than a Ward Leonard hoist and the electrical equipment for the a.c. hoist is only one-third to one-half the cost of a corresponding Ward Leonard hoist.

Several duplicate hoists have been built for foreign service, with no bearing between the two drums, in order to have the drums close to the shaft without exceeding a fleet angle of 1½ deg. This construction employs a shaft 30 in. in diameter.

One company is using a conveyor belt for hoisting ore some 680 ft. underground. The inclined raise slopes 16 deg. 41 min. and is 7x15 ft. in section. The conveyor handles 3,000 tons per day, and the cost of installation is stated to be only half that of sinking and equipping a shaft of the same capacity.

Power Distribution

Some larger mines have made a long-range study of their power requirements and have put into operation an adequate power-distribution system. A system installed in the earlier stages of a mine cannot be extended indefinitely without becoming inefficient in time. For cables carrying 2,000 v. and over, a 19-strand construction is superior to the former 7-strand construction. Neoprene compound is far superior to braided covering. Low-voltage underground cables of this type are markedly resistant to wear and rough handling. For cables carrying over 5,000 v. a copper shield is used; it in turn is covered, but should be grounded.

Some special types of rope clamps for wire ropes up to ¾-in. diameter develop practically the full strength of the rope with one clamp and save the use of several ordinary clips.

Lastly, one promising means of lessening the need for more manpower is the use of electronic control devices for many different purposes about mines. Control of peaks in power loads and skips or cages in shafts, the detecting of smoke, the opening of underground ventilating doors, the serving as an invisible fence to warn of trespassers and the guarding of powder magazines are only a few of the numerous possible applications of these devices.

Few Changes Mark Year In Non-Ferrous Metallurgy

CARLE R. HAYWARD, Professor of Process Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

Among interesting items noted are: The unique system of firing reverberatories at Cerro de Pasco . . . Use of high vacuum to remove zinc from lead . . . The outstanding paper on improvements in metallurgy at Noranda . . . Scholarships in metallurgy have been set up by the Consolidated Mining & Smelting Co. of Canada, furnishing a good example

IN THESE DAYS, when reconversion difficulties are worrying the manufacturing world, the smelting and refining companies have merely to determine the rate at which they should continue production. Unfortunately, this is not so simple as it seems, due to the uncertainties regarding the total probable consumer demand and the extent to which that demand is going to be met by secondary metal.

The situation varies with the different metals and is further complicated by the position the United States holds in the world market with respect to each.

COPPER—No radical changes have taken place in copper metallurgy for many years, yet improvements and changes here and there have not been lacking. Some of these have been of sufficient interest to form the subject of a published paper, and no group in recent years has been more generous in disseminating information regarding their operations than the staff of the Noranda smelter. Metallurgists owe them a debt of gratitude. The most recent paper from this group, "Noranda Smelter From 1939 to 1945," by Boggs, Anderson, and Stevens (C.I.M.M. *Bulletin* No. 398, June, 1945), gives a story of bold metallurgical pioneering. A few of the highlights will be mentioned:

This company has experimented with suspended magnesite roofs on its reverberatory furnaces for many years, first using this type of construction near the flame focus, and since 1940 for the complete roof. In four years on one furnace no time was lost for roof repairs. There is also a net saving in brick costs in

spite of the high initial cost of magnesite brick, the reason being that when a sprung arch is repaired, considerable areas of good brick are destroyed, whereas with suspended arches only the bricks which need replacing are removed.

By using an ingenious method the width of the reverberatory was increased from 27 ft. to 33 ft. without shutting it down, and likewise the height of the roof near the firing end was raised to give a large combustion chamber for increased fuel consumption. The remodeled furnace has reached an average capacity of 2,120 tons of charge per day over a period of one month, with a coal ratio of 10.08 percent.

In attaining these capacities it was found essential so to regulate the charging and firing that an open channel is always maintained along the center line of the furnace. The furnace's abnormal width contributes to this condition.

An innovation at Noranda is the insulation of the roasting furnaces both outside the steel shell and between the shell and the brickwork. This contributes to uniform operating conditions and conserves heat, which is important at a plant like this, which uses no extraneous fuel in the roasters.

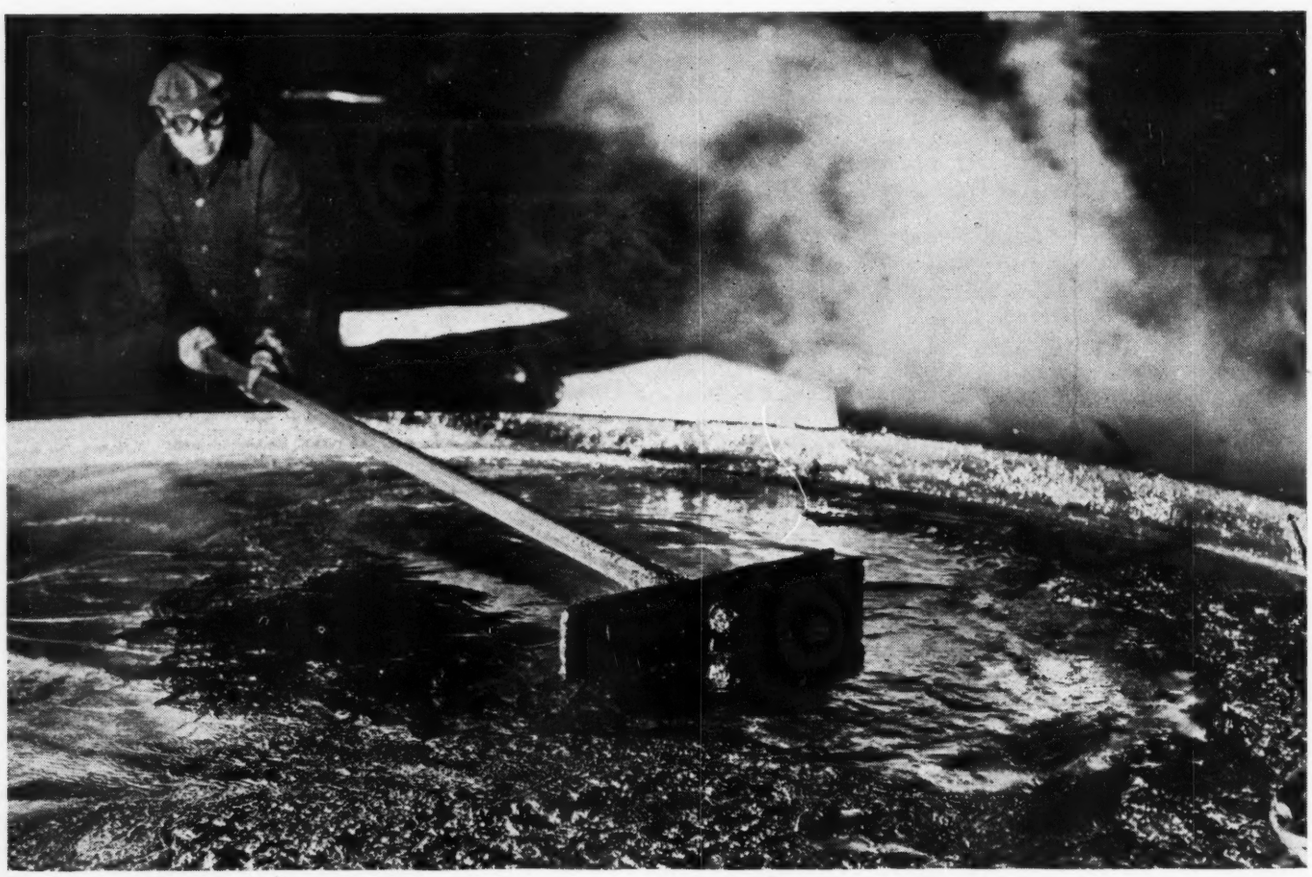
In some plants in the United States there is a decline in the receipts of heavy sulphides, which means a very light roast mainly for drying and pre-heating the reverberatory charge, or else a change to direct smelting. In either case nearly two-thirds of the sulphur entering such plants is now eliminated in the converters, and if acid or liquid SO_2 is to be produced in quantity, the converter gases must be used for this purpose. By taking care to minimize air leakage to the hoods, it is possible to get a 24-hour average of 6 percent SO_2 in converter gases. There may be a fluctuation between 2 and 9 percent, but this as well as the average may be improved if four or more converters are used.

The capacity of a copper converter depends to a considerable extent on the volume of the air passing through it and this in turn on the efficiency of the tuyere punching. This is a laborious operation, and especially in these days of labor troubles and shortages the superintendent has often longed for an automatic punching device. Experiments have been made along this line from time to time and there are rumors that success is in sight. Effective equipment for this purpose should result in direct savings in labor cost and indirect savings due to increased converter efficiency.

At Cerro de Pasco a unique system of firing is used for the reverberatories where the fuel is a combination of short-flame oil and pulverized long-flame coal. The matte produced is very low in grade (16 percent copper), which allows the use of considerable amounts of siliceous silver ore as converter flux. At present the company is using 1 ton of siliceous silver ore to 3 tons of matte.

LEAD—It is many years since a new large deposit of lead ore was discovered, and a serious shortage may develop unless suitable substitutes are found for the metal in one or both of its principal uses—namely, cable covering and storage batteries.

The problem of the lead smelter would, therefore, seem to be not prin-



SKIMMING THE DROSS in a desilverizing kettle in a lead refinery. The principal problem of the lead smelter today seems to be that of discovering ways of preventing losses rather than of developing cheaper smelting and refining methods, in the opinion of the author. This would begin with improving concentration technique and would end with lower slag and fume losses.

cipally the development of cheaper smelting and refining methods, but the discovery of ways to prevent losses. This would begin with improvements in techniques of ore concentration and end with lower slag and fume losses. A serious shortage of lead seemed imminent in the early nineteen twenties, but this was relieved by the development of differential flotation, which made available huge tonnages of ore which up to that time could not yield lead economically. If new lead deposits cannot be found, perhaps we can augment our supply of the metal by further technological improvements.

After it became common practice to remove all the sulphur from lead concentrates by sintering, there was a long period during which no sulphuric acid was made in lead plants. Newly designed sintering machines with three suction boxes and hoods over the pallets make it possible to recirculate the gases and build them up to over 6 percent in SO_2, which is satisfactory for acid manufacture. It is possible to recover as high as 80 percent of the sulphur in the charge in the form of enriched gas.

Successful use of high vacuum in one process for producing magnesium has stimulated its application in other fields. One of these new uses is to remove zinc from lead. The alloy is melted in a kettle and a second kettle of slightly less diameter is inverted above it with the rim dipping into the alloy, which thus forms a vacuum seal. Vacuum is then applied and the zinc distils off at about 700 deg. C., condensing on the cold bottom of the suspended kettle.

There appears to be a new interest in smelting lead-bearing scrap and working it up into marketable alloys. This will doubtless be greatly increased when storage-battery scrap becomes more common.

ZINC—Plants for fuming zinc, and incidentally lead from lead-blast furnace slags, have long been in successful operation at Trail, B. C., and East Helena, Mont. During the war, plants were built at Tooele, Utah, and Kellogg, Idaho, and it is possible that as sources of zinc and lead dry up, further plants may be built. These fumes are primarily zinc but contain 5 to 6 percent of lead, and it is desirable, if possible, to separate them. Volatilizing the lead by heating the solid fume with salt has been used with some success, but a simpler and more satisfactory treatment is to mix the fume with 1.25 percent of coke and heat the mixture. The lead, which is mainly as basic sulphate, is reduced to sulphide and the latter volatilizes, leaving a densified zinc oxide. This procedure is said to be in use at the two most recent plants.

Zinc-producing capacity of the United States is now in excess of ore production. The final outcome of this situation remains to be seen, but if producing capacity is to be maintained, obviously ore importation must continue at a fair volume.

LIGHT METALS—The situation in this field was discussed at some length in the *Engineering and Mining Journal* review last year and it remains about the same at present.

There are frequent rumors that this or that company is to enter the aluminum field by taking over one or more of the idle Government plants. This competition would be welcomed by the Government, but it would seem that very attractive offers must be made before these companies would care to invade the new territory specified.

Scrap aluminum is being worked up in large quantities mainly for purposes where the highest qualities are not necessary. Improved methods for aluminum refining are urgently needed, and it is not too much to expect that such processes will be forthcoming. No one can justly accuse the principal producer of aluminum of being unprogressive or of lacking interest in research, but out of increased competition may come improvements which monopoly did not produce.

The future of magnesium is still an enigma. Most of the war plants have been shut down, and their ultimate use remains to be determined. This metal needs some enthusiastic advocate who can point out numerous new uses for it and have sufficient specifications at hand to convince a prospective user that he can safely substitute magnesium for something else made of metal or some other substance. Its lightness makes it attractive, but some other characteristics frighten customers away. Perhaps systematic research would overcome the difficulties or produce designs in which the objectionable properties would not prove detrimental.

MINOR METALS—The principal field of numerous minor metals is undoubtedly as alloys with the major metals. As knowledge of alloys and their constitution increases, and with it the demand for better and more versatile alloys, it seems probable that some minor metals will assume increased importance.

Little new can be reported at the moment, but it is fair to predict that the complex alloys will eventually provide an important area for research.

Announcement that Consolidated Mining & Smelting Company of Canada has established seven scholarships in metallurgy at $1,200 each should not be passed by without comment. This company is one of the most diversified and progressive in the non-ferrous field, and its example might well be followed by other companies.

Many important technical papers have been published by members of its staff, and its interest in education should be helpful in keeping this staff supplied with bright and enthusiastic young recruits, thus insuring its future leadership.

I still have pleasant recollections of an evening many years ago spent at the home of Mr. Blaylock, general manager of this company. His sound ideas on education and employee-employer relationships were being used in his plant at that time and as the years have progressed have borne abundant fruit.

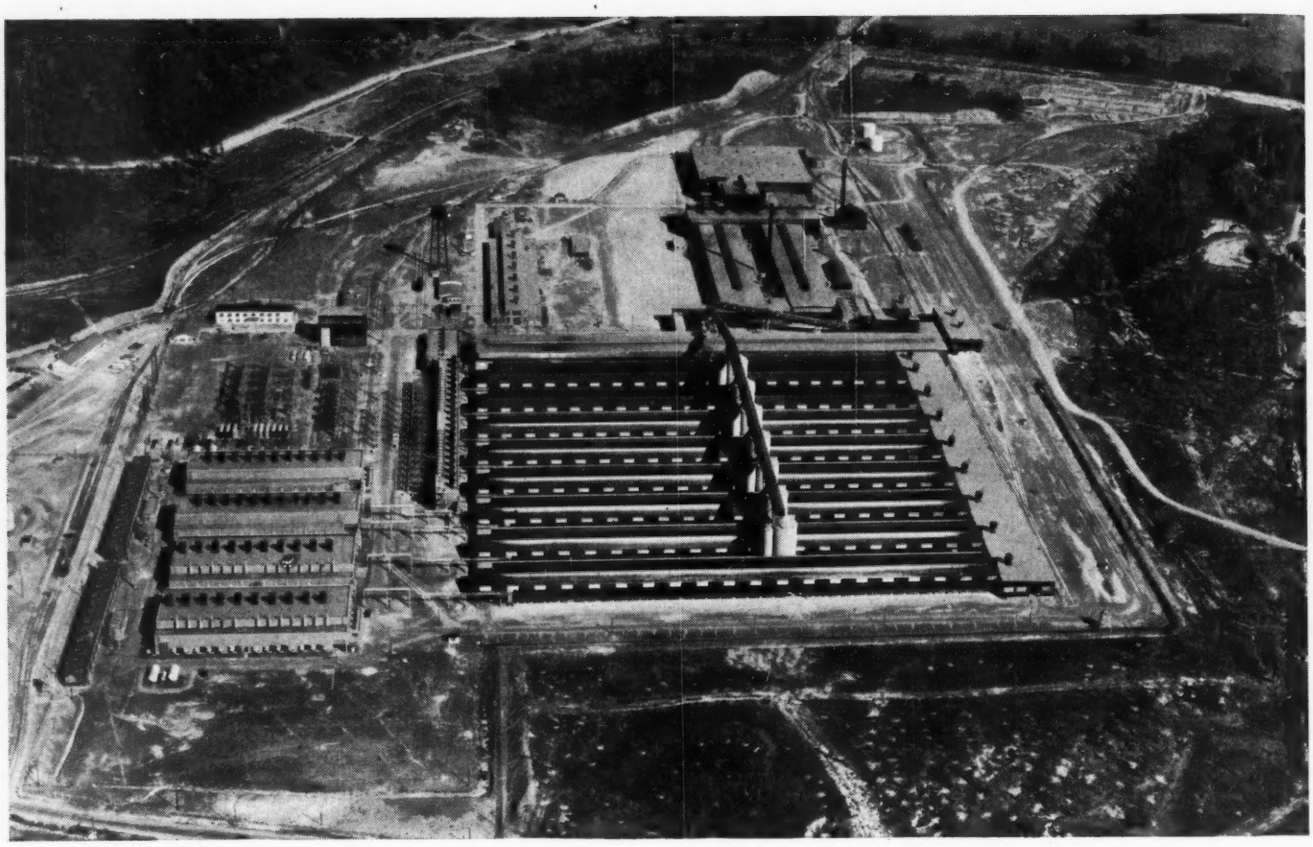
Use of Oxygenated Air

Frequently I have advocated more attention to the use of oxygen and oxygenated air in smelting and refining operations. Twenty years ago an interesting symposium on the subject was held by the A.I.M.E. and from time to time since then an occasional writer has pointed out some advantages in its use.

At present there seems to be considerable interest in this subject in Russia and it will be to the advantage of metallurgists to watch these developments.

Whenever the subject is brought up there is a tendency to brush it aside as impractical because oxygen is expensive. It should be pointed out, however, that, due to a continual dropping of power costs, the potential costs of the production of oxygen on a large scale have also been reduced.

We are too prone to think of oxygen in terms of small, costly cylinders filled at considerable expense by highly compressed gas and shipped to some distance at further considerable expense. Oxygen for general large-scale metallurgical purposes would be produced and handled in ways which would make the cost a small fraction of the cost of cylinder oxygen. It is high time we revised our thinking on the subject.



JONES MILL ALUMINUM REDUCTION PLANT in Arkansas, with annual capacity of 152,076,000 lb. of metal, built and operated for United States Government during war by Aluminum Company of America, has just been leased to Reynolds Metals Company.

Growth of Light Metals Assured—Tonnages Uncertain

JAMES L. HEAD, Mining Engineer, Chile Exploration Co., New York. Formerly Aluminum and Magnesium Division, War Production Board

CESSATION OF HOSTILITIES found the war-swollen, light-metal industry already operating below the record production peaks of 1943. With victory came final removal of restrictive orders, thus releasing these metals to civilian demand.

Reconversion meant for the light metals disposal of the Government-owned plants. These comprised, in terms of installed capacities, 52 percent of the alumina, 56 percent of aluminum ingot, and 98 percent of magnesium ingot. Hearings on the future of light metals had been held by a Senate Committee early in the year. Victory gave the signal for the "trustbusters" to break out in full cry. Capacity with respect to postwar outlook and the technical qualifications and organizational stability of some of the vociferous, regionally minded aspirants for government assistance were largely overlooked in the determination to deny disposal of any units to the group which had built and operated them so efficiently for the war program. As a result, operation of any government facilities by Aluminum Company of America finally terminated on Oct. 31.

Immediate definite interest in aluminum production facilities finally narrowed to the Hurricane Creek, Ark., plant, with annual capacity of 1,555,000,000 lb. of alumina, and the Jones Mill, Ark., reduction plant, having a rated annual capacity of 152,076,000 lb. of metal. Alcoa's offer to lease Hurricane Creek and sell alumina to any Government-ap-

proved operators, while having little chance of acceptance, seemingly brought to a head the matter of subsidy operation and eliminated most of the hopefuls. Reynolds Metals Co. countered with a subsidy-free proposal which by the year's end had been sanctioned by Reconstruction Finance Corporation.

Bauxite for Alumina

Irrespective of the disposition of the Government's ingot and fabricating facilities, bauxite will for many years remain almost the sole source of alumina for reduction to metal. The expansion program afforded, however, an unparalled opportunity to investigate many other sources. Scores of methods cropped up by which hopeful sponsors proposed to extract alumina from such materials as clay, alunite, high-silica bauxite, anorthosite, nepheline syenite, feldspar, kyanite, Fuller's earth, copper-mine tailings, blast-furnace slag, coal ash and waste mine-waters. Few had been developed beyond the early embryonic stage. Four processes were eventually approved for testing in large experimental plants. A fifth process became an important reality. The four plants represent an outlay of nearly 20 million dollars and are generally known as the "alumina-from-clay" plants, although one treats alunite and another is designed to use anorthosite. Only two of the plants (Kalunite and Ancor) have operated; construction of the other two (Monolith and Columbia) is nearly completed. Although there has been no hesitancy in closing plants experimenting in other fields, these particular plants are evidently an exception and work is continuing.

Kalunite and Ancor

Kalunite, Inc., subsidy of Olin Industries, at Salt Lake City, Utah, treats alunite by a process which had been developed over a number of years. Alunite, hydrous sulphate of potassium and aluminum, after crushing and dehydration, is leached with dilute sulphuric acid solution. The resulting normal potassium alum solution is converted by autoclaving to a basic alum precipitate which on calcination results in a mechanical mixture of soluble potassium sulphate and insoluble alumina. The alumina after separation and calcining is suitable for reduction. The potassium sulphate is then crystallized from the filtrate. Reclaiming of sulphuric acid and marketing of the potassium sulphate are essential to commercial application.

Operations at Kalunite started in September, 1943. It has produced only a small fraction of the anticipated daily output of 100 tons and no potassium sulphate has been made. Failure of this operation is due to faulty design and poor choice and arrangement of equipment rather than to lack of fundamental chemical soundness.

Ancor Corporation, at Harleyville, S. Car., has made a small amount of alumina from high-alumina clay in a plant designed to produce 50 tons per day. Clay is sintered with high-calcium limestone (marl) and soda ash to form a mixture of dicalcium silicate and soluble tricalcium aluminate. Leaching with sodium carbonate solution produces sodium hydrate and sodium aluminate which are separated by filtration. Combined silica is removed and aluminum hydrate precipitated with carbon dioxide, regenerating sodium carbonate.

Construction was practically completed late in 1944 but because of necessary additions and mechanical revisions production has been small. Economic possibilities are largely dependent on utilization of the dicalcium silicate residue either as raw material for cement manufacture or as a lime substitute in soil conditioning.

Monolith and Columbia

Still speculative is the anorthosite treatment in the 50-ton per day plant of Monolith Portland Midwest Co. at Laramie, Wyo. The process was developed by the company, whose cement plant adjoins, to obtain as residue a material suitable for production of low-alumina, high-silica cement.

The Monolith process is similar to Ancor's in that it involves the sintering of a mixture of high-calcium limestone and an aluminous material (anorthosite) with subsequent leaching. Soda ash is added to form soluble sodium aluminate and dicalcium silicate during sintering. The former is taken into solution by leaching and then filtered from the insoluble residue. After formation and separation of insoluble zeolites by the application of lime under heat and pressure, alumina is finally precipitated as dry hydrate by saturation with CO_2.

Construction was started in December, 1943, but the plant is not yet in production. One competent observer has estimated that the cost of alumina will be prohibitive, even discounting the possible value of the dicalcium silicate residue.

The enigma of the lot is the plant of Columbia Metals Corporation at Salem, Ore., which is being built to employ an ammonium sulphate process developed by Chemical Construction Co. for treatment of Pacific-Northwest clays. Successive steps of the process after dehydration and grinding involve digestion in a hot bisulphate solution, crystallization and separation of the dissolved ammonium alum, resolution of the ammonium alum and precipitation of aluminum hydrate by means of an aqua ammonia solution. Additional steps recover aluminum sulphate reagent for reuse and ammonia gas. Inauguration of operations is a year behind schedule. Chemistry of the process is considered fundamentally sound but final determination of the best methods and equipment for its application must await operating experience.

The Combination Process

The only notable development in alumina production has been Alcoa's combination process by which the "red mud" waste of the Bayer process is sintered with limestone and soda ash for the recovery of additional alumina. Sintering unlocks the complex sodium aluminum silicate of the red mud, fixes the silica by the lime as insoluble dicalcium silicate and converts the contained alumina to soluble sodium aluminate which is returned to the main Bayer plant. A residual "brown mud" is discarded. The beneficial aspect of the development has been recovery of 85 to 90 percent of the alumina from low-grade bauxite containing 10 to 18 percent silica, whereas the Bayer process alone could have recovered only about 70 percent from similar material and is limited to 80 to 85 percent recovery from high-grade.

Government sintering facilities were completed at Hurricane Creek and Aluminum Ore Co.'s East St. Louis, Illinois, works. An installation at the Government's alumina plant at Baton Rouge, La., had not been completed before operations were discontinued in July, 1944. Availability of imported bauxite made it unnecessary to proceed with a sinter plant at Aluminum Company of America's Mobile, Ala., plant.

Development of the combination process makes available much domestic bauxite previously considered unsuited for the Bayer process. Substantial additional tonnage of these lower grades was disclosed by exploratory activities during the war. Private operators discovered many new orebodies but the main program was the cooperative one of the U.S. Bureau of Mines and the U. S. Geological Survey in the three states of Arkansas, Georgia and Alabama, respectively.

Prewar reserves of Bayer-grade bauxite, that is, material with a 55-percent alumina minimum and not more than 7 percent silica, amounted to about 17,500,000 long tons. Despite the drain of the war years—2,648,400 long tons in 1942, 6,289,750 long tons in 1943, 2,825,400 long tons in 1944, and approximately 1,200,000 long tons for 1945 — domestic reserves now probably are about 34,500,000 long tons suitable for the combination process (less than 15 percent silica). In addition, Metals Reserve's bauxite stockpile on Oct. 31 amounted to 2,713,000 long tons. Reserve figures may be subject to adjustment inasmuch as they do not give consideration to the losses that would be incident to mining the deeper ores by underground methods.

Conservation Still Wise

Reduction to approximately the prewar mining rate does not preclude the necessity of conservation of domestic reserves of this scarce raw material and utilization of imported bauxite. Beneficiation may at some future time afford an additional safety factor for the reserves but notwithstanding much experimentation, concentration of bauxite by orthodox mineral-dressing methods remains an erratic and unpredictable procedure. The most ambitious attempt in this line is the United States Bureau of Mines' 50-ton-a-day pilot plant, situated in Saline County, Arkansas.

Mining in Surinam and British Guiana was greatly curtailed. Alcoa's subsidiary continued to ship high-grade bauxite to Mobile but neighboring operations of the Billiton Company were discontinued. Aluminum Company of Canada supplied its needs from its mines in British Guiana. Imported bauxite was again available to the chemical and abrasive industries and plans are being made to increase this business.

New Finds in Caribbean

Search for deposits of bauxite materials continued in the Caribbean area with reports of important discoveries in Jamaica and Haiti. From its Haitian deposits Reynolds has shipped a small tonnage for test purposes. In the domestic field, Alcoa is testing aluminous laterites from Washington County, Oregon, which, if suitable, may provide its Vancouver reduction works with a nearby source of alumina. High-iron content of the material is a potential by-product.

Magnesium From Dow

Peace finds magnesium metal production confined to Dow's electrolytic process in its private plants. The only other private facility is H. J. Kaiser's Permanente Metals Corporation in California where, according to announcement, production may be resumed. Using the Hansgirg carbothermic process Permanente's wartime costs were very high. It remains to be seen whether subsequent modifications that may be made in the process and equipment can put the Permanente enterprise on a competitive basis.

Disposal of thirteen Government-owned magnesium plants, representing a cost of nearly $370,000,000 is not such a controversial matter. There will be few bidders for these facilities for the production of magnesium. Productive capacity exceeded actual war requirements and at the present time is far in excess of any immediately foreseen peacetime demands.

Swift Developments

Seldom in such a short time has such impetus been given to the technologic developments of a metal as in the case of magnesium. Economies were also being effected and several processes were at the point of offering real competition to the Dow method. It is regretable that much of this development must now be at a standstill.

Basic Magnesium Inc. was particularly active. A modification of its Magnesium Elektron Lmtd. process eliminated peat-moss from the pellets of the calcined magnesite-powdered coal mixutre fed to the chlorinators. Progress was continuous in the application of the ferrosilicon process, both the Pidgeon method and the variation developed by the Electro Metallurgical Corporation. New England Lime Company produced metallic calcium by ferrosilicon reduction. Incompleted projects included perfection of the Mathieson cell and preparation of cell feed by International Minerals and Chemical Corporation from surplus liquor from its potash plant at Carlsbad, N. M. Experimental projects not reaching commercial application were Surface Combustion Corporation's "fireless cooker" or refractory-lined, vacuum-tight steel shell developed for the ferrosilicon reduction process and a carbothermic process that has been developed by the United States Bureau of Mines in cooperation with the Ford Motor Company.

Outlook for Light Metals

The future growth of the light metals is assured but tonnage requirements of the immediate future is anybody's guess. In aluminum's case the facts are less uncertain. There are few instances where it should not regain its prewar uses. The industry claims that the number of different uses developed as a result of research and experimentation undertaken for military purposes and by planning for the post-war period has nearly doubled. However, the policies which have delayed and made difficult the disposal of Government-owned plants have enabled the Canadian producer to increase an already advantageous export position.

Magnesium, with little prewar competitive status on which to base assumptions, is a dark horse. As said before, few metals have been subject to such rapid development. This fact alone probably makes necessary considerable backtracking, checking and reappraisal. Competent organizations are engaged in this work and the industry is benefiting from a well-organized publicity campaign. The Magnesium Association, which has been organized by those in the industry, is nearly two years old.

Late post-war consumption estimates of these metals are those of Surplus Property Administration in its reports to Congress. These indicate a possible annual requirement of a billion pounds of primary aluminum metal within five years after the war supplemented by 600 million pounds of secondary metal and for magnesium a probable annual consumption in the United States during the same period of 50 to 65 million pounds.

Non-Metallics Turn From War To Peacetime Industries

OLIVER BOWLES, Chief, Non-Metal Economics Section, and
WILLIAM H. WAGGAMAN, Mineral Technologist, U. S. Bureau of Mines

Fundamentally important in that they are essential in a multitude of applications in the every-day life of the Nation, the non-metallic minerals will inevitably play a vital role in the economic situation. A good example is furnished by the fertilizer minerals. At present the phosphate industry is enjoying a boom and can sell all it can produce, which appears likely to endure for several years

NOW THAT non-metallic minerals are being released from military service, they have a multitude of postwar jobs. Not only must they supply our normal peacetime needs and make up a tremendous backlog of unsatisfied civilian requirements, but they will be called upon to rebuild ruined industrial plants and devastated cities of a war-torn world. The advent of peace will undoubtedly result in curtailed production of some of these minerals, but the demand for others should be much above that of prewar days, and for some of them greater than in the period 1942 to 1944.

The non-metallics have been accorded so little credit for their wartime services that, before reviewing the progress made in 1945, it seems only fair that some recognition be given them for the indispensable part they played in bringing about our final victory over the Axis powers.

Non-Metallics in the War

Without adequate supplies of industrial minerals, America could not even have defended herself, much less conducted an offensive war. The lowly drilling mud as well as the high-priced diamond drill did much toward locating our strategic mineral deposits from which weapons are derived; non-metallic refractories of fireclay, kyanite, chromite, and graphite were used as linings for the furnaces and smelters into which were fed limestone, fluorspar, and other non-metallic fluxes required to extract values from our metalliferous ores.

Abrasives, such as corundum, garnet, emery, and various carbides, were used to fashion, fit, and polish our finished weapons; mineral phosphates, potash and nitrogenous compounds kept our agricultural production at such a high level that we not only had the best clothed and fed military forces in the world, but were able to contribute liberally to the urgent need of our allies.

Asbestos, talc, and mica were employed in a wide variety of equipment for electric and heat insulation, and pure quartz crystals for telephony and radio frequency control, played a major role in maintaining vital communications.

There is no question that America would have gone down to early defeat had we not developed our resources of these materials and taken full advantage of their physical and chemical properties.

Under the urge of war necessity, improved techniques for winning the non-metallics from their natural occurrences and beneficiating them were worked out, and new or expanded uses for the products derived therefrom were promoted. The following discussion is confined to the leading commodities.

ABRASIVES—Few materials vary so in availability, value, and physical properties as those classed as abrasives. The value of natural abrasives consumed in 1945 was probably close to that of 1943, when it reached an all-time high. Military needs have been heavy, but these fell off sharply when hostilities ceased in the latter part of the year. On the other hand, the revival of the automobile industry and the renewed manufacture of many types of civilian goods should take up much of the slack caused.

Industrial diamonds, including crushing bort, were in strong demand and stocks were drawn upon heavily. In addition to their use as cutting tools and for abrasive purposes, they play an important role in drawing fine wire. The Bureau of Standards has developed an electric arc process of drilling diamond dies, which is said to reduce the time required to produce them, from several weeks to a matter of hours.

Ankerite Gold Mines, Ltd., South Porcupine, Ont., found that tourmaline occurring in certain parts of the mine is an excellent grinding medium in tube mills. Because of its high specific gravity and superior hardness it has reduced grinding costs several cents per ton.

In addition to the standard types of manufactured abrasives such as fused alumina and carborundum, tungsten and titanium carbides appear to have a promising future.

FERTILIZER MINERALS — The necessity of increasing crop yields to supply the needs of an undernourished world has created a greatly increased demand for agricultural minerals, which bids fair to continue for several years.

Phosphates. Production of phosphate rock in the United States dur-

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ing 1945 was maintained at a high level, and while the final figures have not yet been compiled, the tonnage is expected to be appreciably greater than in 1944, when nearly 5,377,000 long tons was produced.

A number of patents on separating finely divided phosphates from associated impurities by flotation were issued in 1945, some of them based on floating the phosphate and others on floating the siliceous impurities. Interest continues in the production of defluorinated phosphate rock both by calcination processes and by fusing at high temperatures in the presence of water vapor. Coronet Phosphate Co., in Florida, and the Tennessee Valley Authority have built plants for making such products for fertilizer and stock feeds. Superphosphate (20 percent P_2O_5) is still the main product employed for fertilizer purposes, but the production of concentrated superphosphate (45 to 48 percent P_2O_5) appears to be growing in favor, particularly in areas where the cost of shipping to distant markets is important.

Discovery of phosphate rock in Frontenac County, Ontario, Canada, has been reported, but its value and extent are not yet known. Cessation of hostilities has made available a large tonnage of elemental phosphorus formerly used for incendiaries and smoke screens, but it appears likely that industry can absorb this additional supply by converting it into phosphoric acid to be used in fertilizers, food and chemical products.

Methods of recovering phosphoric acid and vanadium from the vanadiferous shales occurring in the Western phosphate field are being investigated by the Bureau with a view to obtaining two salable products. New organic and inorganic phosphates for rust-proofing, detergents, plastics, catalytic agents, yeast cultures, fireproofing, and glass products are being made by leading chemical companies, and there is ample evidence that the field of usefulness for phosphate derivatives is being greatly broadened.

Potash. Production of potash salts in the United States continued at a high level in 1945, and domestic deposits furnished the bulk of the potash consumed in this country. The value of exports was about twice that of imports. Figures for 1945 are expected to show a greater tonnage than those of 1944, when 1,578,000 short tons of marketable potassium salts were produced. Four states—California, Maryland, Utah, and New Mexico—produced potash, but most of it came from the Carlsbad area.

Since the known potash reserves of marketable grade in the United States are limited, further exploration by the Federal Government in promising areas has been strongly urged by the Department of Agriculture to insure this nation greater security. The Department recommended that we import a substantial proportion of our requirements.

A number of flotation patents were issued in 1945 pertaining to the separation of potash from other salts suspended in saturated brine solutions. Interest continues in the possibility of recovering potash from potash shale (wyomingite) where it occurs in close proximity to large deposits of trona. The Bureau has proposed a base-exchange process, yielding two salable products.

Nitrogenous Minerals. Most of the nitrogen consumed in 1945 was produced by synthetic means, but a substantial tonnage of ammonium sulphate was obtained as a byproduct in metallurgical coke manufacture. Pressing military needs for explosives resulted in expansion of the nitrogen industry to a point much beyond our peactime requirements, but part of this production (byproduct ammonia) will automatically decrease as the demand for steel falls off. The annual capacity of the 18 domestic synthetic nitrogen plants, nine of which are owned by the Defense Plant Corporation, is 1,450,000 tons of fixed nitrogen, which is far beyond any domestic demand that can be foreseen for some years to come. Eight of the Government-owned plants have been declared surplus and are offered for sale.

BUILDING MATERIALS—Inasmuch as building restrictions, except those relating to Government-sponsored projects, were not lifted until the latter part of the year, the effect of the war's termination on materials such as stone, cement, gypsum, clay, sand, and gravel is likely to be reflected only moderately in the production figures for 1945. Now, however, a boom in building materials of mineral origin is to be expected because an enormous backlog of deferred building accumulated during the depression and war years. A broad program of construction work is already planned and expenditures amounting to $5,600,000,000 are contemplated for Federal-aid highways, flood-control projects, and waterways. Public buildings of various types are in prospect. In addition, the acute housing shortage is receiving much attention, and a building program calling for immense tonnages of non-metallic mineral

THE NEW BONNY LAKE WASHING PLANT of Southern Phosphate Corporation in the Florida pebble field as it appeared in November before construction was finished. Great activity marks the operations in this area, owing to the prevailing demand for phosphate rock.

products will undoubtedly get under way in 1946 and continue for several years.

Production of light-weight, strong aggregates suitable for construction purposes has been the subject of intensive study by Government agencies and private enterprise. Asbestos, expanded vermiculite, and perlite bonded with cement or gypsum offer promising possibilities in this field. These products, along with mineral wool, are also excellent heat-insulating agents. The Johns-Manville Corporation has perfected a number of products, among them an asbestos sheet as thin as cigarette paper. Asbestos in combination with plastics appears to have a promising future in products that are resistant to moderately high temperatures.

Although the largest consumption of clay is in the structural field, materials classed under this general heading differ greatly in chemical composition and physical properties, and are used for such a wide variety of purposes that it is hardly possible to state what industry is served best by clay and its derivatives.

Highly specialized products such as bentonite and fuller's earth should hold their own where used in filtering operations and in clarification of oils, fats, and waxes. Use of bentonite in rotary drilling mud reached an all-time high in 1944, but a slackening of exploratory work probably curtailed demand for it in the latter part of 1945.

The chief use for china clay or kaolin is in paper manufacture, but it also is used in various structural materials and is a basic ingredient of ceramic products. Output of kaolin in 1944 was slightly less than in 1943, but now that restrictions on civilian use have been lifted, we can expect an increase in the consumption of it for china and household ceramic ware.

Interest continues in the practicability of extracting alumina from certain types of clay. Both acid and basic processes have been under investigation by the Bureau and other Government agencies and by private industry, and progress has been made. Now that the shipping lanes are open, high-grade bauxite from South America is available in large quantities, but it would be a mistake to let down on fundamental investigations, which may render us independent of foreign sources.

CERAMICS AND REFRACTORY MATERIALS (OTHER THAN CLAY)—Feldspar and high-grade kaolin for ceramic products are much in demand. Although consumption of light-weight and heavy-duty refractories suitable for furnace linings and heat-regenerative equipment should be less than during the war, these materials are equally important in time of peace, and the investigations in these fields of research have brought about developments which promise to be of great value in the postwar world.

An electrically heated kiln for quick firing of ceramic products has been successfully operated at the Bureau's station at Norris, Tenn. This station has made good progress in basic investigations of superduty refractories.

Feldspar. Shortage of labor for hand-picking high-grade feldspar suitable for glass and ceramic products has caused some of the larger producers to turn to flotation to obtain satisfactory concentrates. This method is gaining in favor and will no doubt be widely used in the future. The largest feldspar concentrator in the world was put into operation at Kona, N. C., by Consolidated Feldspar Corporation in 1945. Small quantities of long-chain amines and hydrofluoric acid are employed as flotation agents. The outlook for feldspar in tile and enamel products, of which civilians have been deprived for several years, appears bright.

Glass. The versatility of glass continues to increase. In addition to its many conventional uses, it is entering more and more into the field of structural materials, not only on account of its light-transmitting properties, but because of the durability and ornamental qualities of its products. Fiber glass is being employed in fabrics and even as a substitute for kapok in Navy life-jackets. Progress is also being made in combining fiber glass with plastics, resulting in both durable and strong products. A phosphate glass has been developed which is resistant to the action of a strong solution of hydrofluoric acid, and by adding aluminum metaphosphate, glass is obtained which is said to have a high capacity for transmitting ultraviolet light. Silicones or organic compounds of silica continue to offer promise of a series of new products covering a wide field of usefulness.

Kyanite and Sillimanite. At the College Park, Maryland, and Norris, Tennessee, stations of the Bureau of Mines, electrostatic separation and flotation have been successfully employed in removing kyanite from quartz, using fuel oil and sodium metaphosphate as flotation agents. Bricks made from domestic kyanite with a suitable bond compare favorably in many respects with those made from imported kyanite. Lightweight refractories meeting the rigid specifications of the Navy Department, which call for products capable of withstanding sudden changes in temperatures, have been successfully made from domestic kyanite. Spark plugs, porcelains, and refractories have been prepared from domestic sillimanite, and sillimanite brick are under investigation. Satisfactory concentrates have been obtained from Georgia sillimanite ore by attrition grinding, followed by tabling and magnetic separation.

HEAVY CHEMICAL MINERALS—For the past four years the immense consumption of heavy chemicals for military purposes resulted in an unprecedented production of such non-metallic minerals as fluxing limestone, salt, sulphur, fluorspar, cryolite, and various other fluxing agents. Curtailment in consumption of some of these minerals is to be expected under peacetime conditions, but for the next year or more reconstruction, unsatisfied civilian demands, and new outlets for a number of heavy chemicals will no doubt make up in part for the drop in military needs.

Limestone. Curtailment in steel production will adversely affect the output of metallurgical-grade limestone, but the demand for agricultural limestone should continue heavy, and, so far, there appears to have been little curtailment in the output of soda products made through the medium of limestone.

Sodium Chloride. The use of salt and brines in manufacture of caustic soda, chlorine, and metallic magnesium reached enormous proportions during the war, but undoubtedly the demand for some of the products derived from salt will be greatly curtailed under peacetime conditions. On the other hand, the lifting of restrictions on civilian goods in the production of which salt plays an important role should have some compensating effect. Relatively new products, such as D.D.T., certain plastics, synthetic rubber, and refrigerants containing chlorine, require substantial quantities of salt derivatives. The advent of war brought about further industrial de-

(*Continued on page* 170.)

New Reagents and Methods Mark Ore-Dressing Advance

S. A. FALCONER, Mineral Dressing Laboratory, American Cyanamid Co., Stamford, Conn.

Good progress in iron-ore flotation was made this past year, and improved reagents and processes for sulphide flotation separations were developed. Use of automatic control devices increased; research was intensified.

THE YEAR BEGAN for ore dressing, as in almost every other branch of mining, in a scramble for more tonnage through the mill and for manpower to keep the wheels turning. As the year ended, the call for tonnage had dropped, but manpower was still the problem. However, much technical work has been done this past year.

Perhaps the most significant development of all has been the growing appreciation among millmen of the importance of research in devising the best possible milling practice. It is noteworthy that at least two large organizations are now employing young men who are products of highly developed mineral-dressing research laboratories, and whose work in those laboratories dealt largely with purely theoretical aspects of mineral dressing.

This would indicate perhaps that theory is not as "pure" as we once thought, and that a deal of practicality may be concealed in the intricacies of fundamental research in mineral dressing. This recognition of the importance of research has been long delayed.

Grinding

There are few mills in the country where grinding tests are not almost continually in progress. Data gained from visits to various mills indicate that in general grate mills with rationed ball charges and with medium circulating loads seem to be doing the best work, but it is not safe to lay down any general law about grinding practice. In the matter of single vs. multiple stage grinding, for example, there seems to be nothing to do but choose the system best suited to conditions to be met.

Forged steel balls are still being tested against balls cast locally, and it seems to be possible that with a source of scrap iron and a ball foundry near by, cast-iron balls in certain cases may cost less per ton of ore ground than steel balls, even though steel balls invariably wear longer. The only answer seems to be to try both and find out which costs less to use, keeping, of course, a careful comparative cost and tonnage record. The same thing is true of ball-mill liners made of alloy steel as against liners made, for example, of rail sections bedded in concrete.

Two forthcoming papers entitled "Fine Crushing With a Rod Mill at the Tennessee Copper Company," by J. F. Meyers and F. M. Lewis, scheduled for presentation at the February, 1946, meeting of the A.I.M.E., describes the results of some interesting experimental work conducted in the Tennessee Copper Co.'s mills.

Based on the data obtained, the authors conclude: That a rod mill is a satisfactory fine-crushing machine; that the rod mill controls the discharge product by sizing or screening function; that when used as a fine crusher, it functions best in open circuit, at least at the Tennessee Copper Co. plant.

In a paper (T. P. 1819) entitled "Principles of Comminution — Size and Surface Distribution," published in the May 1945 issue of "Mining Technology," A. M. Gaudin and S. S. Yavasca present a contribution to the theory of mechanism of comminution and of the work of crushing. The results reported in this paper show that in the fine sizes the new surface per grade is independent of size.

Further light on the subject of mill liners was presented by W. L. Howes in a paper (T. P. 1795) entitled "Considerations of Mill Liners," which appeared in the March 1945 issue of "Mining Technology." Few will quarrel with the author's conclusions that "liner design, liner material, and liner volume combine to make up liner life and grinding capacity. With grinding operations usually the greatest single branch of milling expense per unit of capacity, and every inch of liner thickness costing an average of 5 percent of grinding capacity, development of long-wearing liner designs and liner materials can yield substantial dividends in costs of operation and production."

Classification

Though there were no strictly new developments in classification equipment or processes during 1945, some interesting work has been done on the Iron Range in Minnesota on the current washer fines, and in Florida on phosphate fines, in desliming and hindered settling classification.

It is reported that the Dorrco hy-

droseparator and Dorrco sizer form a valuable addition to many iron ore flowsheets. The former apparatus is used to remove slimes and the Sizer treats the deslimed sands (—35 mesh +80 mesh) to produce iron concentrates of marketable grade. Similarly, on phosphate fines, the combination of the above-mentioned machines is used to produce phosphate concentrates that are of marketable grade.

Heavy-Media Separation

During 1945 new Heavy-Media separation plants were placed in operation by Evergreen Mines Co. at the Buckeye mine, near Grand Rapids, Minn., and by the Scotia Mining Co. near State College, Pa. Both these plants treat iron ores.

In addition three other Heavy-Media separation plants are in prospect for 1946 operation. One of these is a 25-ton-per-hour plant to treat fluorspar ore mined by the Aluminum Ore Co., of Rosiclare, Ill. The other two are designed to treat iron ore, one at a rate of 150-tons-per-hour, and a second at a rate of 40-tons-per-hour. Plans are also in preparation for a fourth plant to treat from 20 to 40-tons-per-hour of magnesite ore.

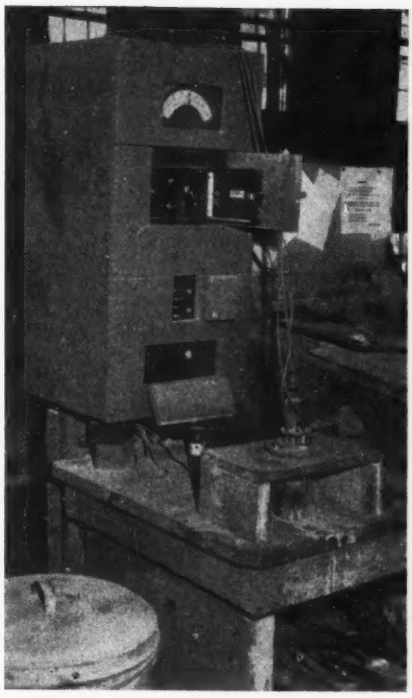
Early in 1945, the Eagle-Picher Mining & Smelting Co. converted its Heavy-Media separation plant to use ferrosilicon in place of the galena medium formerly employed. The Mascot, Tenn., operation of American Lead, Zinc & Smelting Co. remains the only one of the Heavy-Media separation plants that is still operating with galena for the medium.

One of the interesting developments resulting from extensive work on coal treatment is that it has been found possible to extend the application of Heavy-Media separation processes to sizes as fine as 35 to 48 mesh. Some modification of the original flowsheet becomes necessary, but the basic principle of operation remain the same as when treating coarser sizes.

With the advent of peace, metal and coal mines are being reexamined with the thought in mind of improving mining and milling practices to meet current labor shortage and the threat of rising costs. As an example, a Western gold operation has been doing an extensive amount of testing with a pilot-plant size Heavy-Media separation unit. The object of this investigation is to determine the possibility of enriching low-grade ore to the point where milling can be made profitable. The results of this work have demonstrated that approximately 50 percent of the ore as mined can be rejected in a waste product of approximately the same gold content as the tailing that could be made by cyanidation and flotation of the total ore. This operator therefore is now contemplating an installation to treat 3,000 tons of ore per day. The minus-8-mesh ore and the sink product will first be ground, and then it will be treated by flotation and cyanidation.

During 1945 a small sink-float plant was installed by the Sink & Float Corporation for Western Metals Corporation, at Keller, Wash. This plant is reported to be treating one or two tons per hour of fluorite ore and producing a sink product of marketable grade. Presumably, finely ground galena is being used for heavy media.

In the last operating season, a new type separator developed by Colorado Iron Works for use in Heavy-Media separation was tested at the Harrison plant of Butler Brothers on the Mesabi Range. Good results are reported and investigations will be continued during the coming season.



CONTROL OF pH in Treasury Tunnel mill is effected from this center with a Beckmann meter, electrodes, and pushbuttons.

Gravity Concentration

L. S. Prater and Prof. A. W. Fahrenwald have made certain laboratory tests on combined screening and classification as an inexpensive substitute for sink and float. The results of their experiments are discussed in a paper (T. P. 1898) entitled "Combination Classification-Sizing Process of Mineral Concentration," published in the July, 1945, issue of "Mining Technology."

The Humphreys spiral continues to be tested on numerous ores, with great interest being shown by foreign mining companies producing tin, tungsten, chromite, manganese, and the like. In this country test work is under way in iron-ore, treatment plants and coal washers.

A new concentrator, designated the Holman-Michell Flotation Table, for agglomerate tabling of ores is described in an article by F. B. Michell, entitled "Table Flotation," in the December issue of the *Mining Magazine* (London).

Flotation Reagents

In connection with a broad program of reagent and process development for the treatment of oxidized base metal and non-metallic ores, particularly iron ores and tailing products, a number of flotation reagents have been developed in the Cyanamid mineral dressing laboratory. These reagents are designated the "800 Series Reagents." In addition to being particularly good promoters for iron oxides, they show promise in the flotation of certain non-metallic minerals such as fluorspar, barite, and also garnet, scheelite, and wolframite. One member of this group of reagents works well in feldspar ores, and a plant already in operation and two other plants under construction will use this reagent for feldspar beneficiation. Another plant being built will use one of the "800 Series" reagents for the selective flotation of garnet.

Other new processes and selective reagents developed by Cyanamid investigators for the treatment of the so-called "Nelsonite" ilmenite ores were tested in a pilot plant at Piney River, Va. The good results obtained in the laboratory were confirmed in the pilot plant and a full-size flotation plant will be installed during 1946 to replace the existing gravity concentrator on this property.

Although much work has been devoted to non-sulphide ore flotation, the possibilities for advancing the art of sulphide flotation have not been neglected. New selective sulphide depressants and processes have been developed in the industry, and they have been found particularly adaptable to making a clean-cut separation of molybdenum and copper sulphides from bulk concentrates of these minerals. Because of the effectiveness and low cost of these depressants they offer attractive possibilities of supplanting older, more costly methods of separation. American Cynamid Co. has been appointed sub-licensor for these new processes.

Recent tests with the "600 Series" gangue depressants on some of the Southwestern copper ores indicate that these reagents may be used to improve grade of concentrate as well as recovery of copper.

Iron Ore Flotation

Considerable attention continues to be devoted to the beneficiation of iron ores by means of flotation. At least three pilot flotation plants were operated during 1945.

For the past several years American Cyanamid Co. has been actively engaged in the development of an economic, effective, and simple flotation process for treating iron ores and washer wastes. As the result of this work, a number of novel procedures and reagents have been developed, whereby iron minerals such as hematite, limonite, martite, siderite, or magnetite may be selectively floated away from quartz and silicate gangue minerals. The reagents used to float the iron minerals are of the anionic type, cheap in cost, and readily available. The simplicity of the flotation operation itself will be apparent from the following description of the 10-ton-per-hour pilot plant which was operated last summer at the Patrick plant of Butler Brothers, on the Mesabi Range, using one of the several processes developed in the Cyanamid laboratory.

The Pilot Plant

In the course of operating this pilot plant washer tailings from three different orebodies were tested. The tailings were sent to an 18-ft. Dorr Hydroseparator, where slimes in the neighborhood of 20 microns were overflowed to waste, inasmuch as they were refractory and low in iron. The underflow of the Hydroseparator went to a 12-ft. Dorr bowl classifier for removal of any minus-20-mesh slimes remaining. The bowl classifier sands were conditioned with reagents for approximately two minutes. Pulp density during conditioning was 65 percent solids and all of the reagents were fed to the first cell of the 4-cell conditioner. The conditioned pulp was then floated in four No. 20 Steffensen air flotation machines, which gave a retention time of approximately 4 minutes. The concentrate obtained in this roughing operation was cleaned twice in two 2-cell Steffensen machines. Using this flowsheet, it was possible to obtain 60 percent concentrates from tailings carrying 20 to 30 percent iron. Recoveries ran as high as 96 percent. The process and reagents developed for the treatment of iron ores have been found to work equally well on magnetite and martite ores as on hematite ores. They have proved successful on the Minnesota taconites as well as on washer products. The processes and reagents work satisfactorily with the ordinary water available for milling purposes on the Iron Range in Minnesota and they are not at all sensitive to change in grade of feed.

Last season, a pilot flotation plant was also operated by the Minerals Separation Co. to investigate various procedures and reagents developed by that organization. This pilot plant, near Coleraine, Minn., was designed to handle from 5 to 7 tons per hour. It is understood that the procedure used involved multiple-stage conditioning and flotation steps, and that the reagents used included starch, lime, and a saponified fatty acid such as talloel for selective flotation of silica away from hematite. These, as well as other procedures and reagents, are described in U. S. Patents, 2,364,618, 2,364,777, and 2,364,778, granted Dec. 12, 1944, to Messrs. Brown and Tartaron and assigned to Minerals Separation North American Corporation.

At the Danube washer of Pickands-Mather Co. a 3 to 5 per hour pilot flotation plant was operated last season on current washer tailings utilizing various processes for selective flotation of silica from the iron as well as the reverse procedure of selective flotation of iron from silica.

Flotation Machines

A relatively new flotation machine, the Massco-Fahrenwald, has been tested in a number of mills, and good results are reported. This machine makes use of an impeller made of a disk set horizontally on the lower end of a solid shaft, and bearing radial vanes on its upper surface. Offered by Mine & Smelter Supply Co., the new machine was announced in November.

Another new flotation machine, designated the "Turbo-floater," has been investigated by International Minerals & Chemical Corporation for the flotation of potash ores at Carlsbad, N. M. James A. Barr, chief engineer of the company, reports that results at Carlsbad continue satisfactory and that additional cells have been installed. A Turbo-floater unit, similar to that described in A.I.M.E., T. P. 1922, was installed during 1945 at the company's Peace Valley, Fla., phosphate flotation plant. Results are favorable, but no conclusion may yet be drawn.

Considerable interest in the Steffensen air flotation machine continues to be shown, particularly for the treatment of non-metallic minerals. At present, flotation plants are under construction for the treatment of a garnet ore, and two feldspar ores, wherein Steffensen machines will be used. Steffensen machines were operated in the iron-ore pilot flotation plant referred to previ-

ously. Another flotation pilot plant equipped with Steffensen air flotation machines is contemplated for the recovery of martite from a mixed magnetite-martite ore.

There is a growing tendency towards the use of larger size flotation units. Many of the flotation-machine manufacturers are prepared to supply units ranging from 60 to 100 cu. ft. The respective merits of a lesser number of large units versus a greater number of smaller units is always a good subject for debate by experienced operators. Eventual choice of size of units would seem to depend on characteristics of the ore and local conditions.

Cyanidation

Cyanidation practice has likewise changed but little over the past four or five years. However, research has not been entirely neglected, as evidenced by two recent papers relating to cyanidation presented at the February, 1945, meeting of the Canadian Institute of Mining and Metallurgy in Quebec. The first of these, "Copper Cyanogen Complexes in Cyanidation," by N. Hedley and D. M. Kentro, deals with the difficulties so frequently encountered in the cyanidation of cupriferous gold ores, of fouling of solution, decreased extraction of gold, and inefficient precipitation of dissolved gold. The authors' research proved that copper combines with more cyanide than was hitherto suspected. Part of this combined cyanide reports as free cyanide by the usual method of analysis, but this indicated free cyanide fails to dissolve gold as readily as true free cyanide does. Therefore, under such conditions, the operator has an erroneous impression of the efficiency of his solutions and he frequently condemns them as "foul" when they merely need the correct addition of cyanide to bring them back to normal. The correct addition of cyanide may be determined by analyzing the solutions for copper, and for total cyanide distillation. When the ratio of copper to total cyanide (combined plus free) is maintained at 1 to 4 or higher, the so-called "fouling" may be obviated. By so doing, several mills have improved considerably their practice.

MILL OF TELLURIDE MINES, INC., treating 350 tons of lead-zinc ore daily. Gold is recovered by jigging and amalgamation and lead and zinc by bulk flotation, the zinc subsequently being floated off.

The other paper previously referred to, "Treatment of Gold Precipitates Containing Copper," by N. Hedley and J. J. Kress, deals as its title indicates, with an improved method developed by the authors for treating gold precipitates high in copper. Mill men who have had to deal with cupriferous gold precipitates are familiar with the difficulties encountered when attempting to flux the precipitates directly. Other older methods, such as prior treatment with sulphuric acid, designed to remove most of the copper prior to fluxing, have not always been reliable and satisfactory. The authors have found that a preliminary treatment with acidified ferric sulphate dissolves the copper rapidly and almost completely, leaving a residue high in gold content which can be fluxed readily. The ferric sulphate solution containing copper and a minute amount of gold may be treated with metallic iron to precipitate the copper in a high-grade product. This product contains, in addition to the copper, the small amount of gold dissolved during leaching.

Mill Control Devices

Numerous mills are now employing various electrical or electronic devices for securing better control of pH, reagents, or rate of feed.

As mentioned in the Annual Review a year ago, automatic pH control is being practiced by Normetal Mining Corporation, and another copper company employs semi-automatic control of reagents additions based on degree of oxidation of the ore pulp as determined by a recoding meter measuring the resistance in ohms between two electrodes which are immersed in a pool of filtered solution flowing from the classifier pool.

Combined Metals Reduction Co. has installed recording meters for measuring pH at six points in each of the Pioche and Bauer flotation circuits. Readings at each of the six stations are recorded separately on one chart at each mill. E. H. Snyder states that at Pioche ores from six mines are treated and at Bauer ores

(Continued on page 167)

Beneficiation of Iron Ore Draws Continued Attention

E. W. DAVIS, Director, Mines Experiment Station, Minneapolis, Minn.

The problem of providing an iron-ore supply adequate for the future needs of the United States has lost none of its seriousness through the ending of World War II. Activities of major producers in creating facilities for iron-ore research and in undertaking to work less-promising, lower-grade deposits in new areas distant from the scene of their customary activities has a significance that is not to be ignored

A LARGE PROPORTION of the iron ore being smelted in the United States is beneficiated to some extent before it enters the blast furnaces. However, if simple crushing and screening are disregarded, and only the more technical processes which substantially improve the chemical analysis of the ore are considered, the proportion is much smaller, being in the order of 20 percent, or about 20 million tons annually. These more technical processes, usually grouped together under the term "concentration," include separation of the valuable ore from the worthless constituents by gravity methods, by magnetic concentration, by heating or sintering, and, to a limited degree, by flotation.

The U. S. Bureau of Mines reports iron-ore shipments of the United States for 1944 of about 95 million tons. Of this amount, concentrate shipments were about 20 million tons, divided as follows: gravity concentrates, 15 million; magnetic concentrates, 3 million; others, 2 million. This does not include the sintering of flue dust at the furnaces or the treatment of byproducts from chemical plants.

By districts, the production of concentrates in 1944 was about as follows:

Minnesota	15 million tons
New York and New Jersey	2 million tons
Pennsylvania	1 million tons
Alabama	1½ million tons
Other states	½ million tons

From this it is evident that Minnesota is the principal producer of iron-ore concentrates, and here, nearly 14 million of the total of 15 million tons came from the Mesabi. Last year the Mesabi produced about 62½ million tons of ore, of which about 22 percent was concentrates, this percentage being about constant for the last five years. In Minnesota and Alabama, nearly all of the concentrates are produced by gravity methods; in the northeastern states magnetic concentration methods are used almost exclusively.

The Question of Reserves

Much discussion has been heard recently regarding domestic iron-ore reserves and the need for conservation. Most attention has been directed toward the Mesabi because it has long produced more than half of the ore smelted here. In addition, nearly all of the open-pit direct-shipping ore available to the great steel centers is produced on this range, and when the reserves are exhausted, some new source that can supply 50 million tons of ore per year over a long period must be made available. Present estimates, prepared by the Minnesota Tax Commission, show about 500 million tons of open-pit direct-shipping ore remaining on the Mesabi Range.

Factors to be considered in making any exhaustion-time predictions as to the Mesabi have been discussed in previous articles in *E.&M.J.* and elsewhere. They include such matters as the addition of newly found ore to open-pit reserves, the prospective slow tapering off of production in the latter years of the Range, and the fact that most of the Mesabi open-pit ore is owned by one large steel company. Other factors are the tax policy of Minnesota and the Lake Erie price of iron ore, both of which can be changed to make underground mining and low-grade ore concentration more profitable. Probably most important is the national policy toward the conservation of minerals and preparations for future emergencies. The stockpiling of minerals for national defense is again being discussed and, in addition, we now have the "good-neighbor policy" and the suggested plan for dispersing heavy industry as a defense measure against atomic bomb attacks.

Some Proposals

The effect on the iron-ore and steel industries of some of the proposals now being discussed would be far-reaching. The suggestion has been made by W. R. Van Slyke that the Government impound, by some means, two or three hundred million tons of the remaining 500 million tons of Mesabi open-pit, direct-shipping ore, to be held in reserve for emergencies. This program would, of course, upset all exhaustion-time calculations. We are committed, moreover, to importing large tonnages of ore from South America. If this country chooses to be a really "good neighbor," foreign ore may become a factor in the domestic iron-ore industry. In addition, if it becomes advisable to disperse the steel industry, important new smelting districts may develop in the West and Midwest to which Mesabi ore can-

not be shipped economically in peacetime. It is recognized that the Sault Ste. Marie ship canal is a vulnerable bottleneck in the production of steel, and some diversification in shipping facilities may be desirable.

Even casual consideration of these facts show that any reasonable statement regarding the life of the direct-shipping, open-pit or mines on the Mesabi must be so carefully phrased as to be almost meaningless. It is better to say simply that something over 500 million tons of this type of ore remains on the Mesabi. Ore producers and steel companies, however, must make plans for the future, and some of their activities are of interest.

Significant Activities

Oliver Iron Mining Co., which is U. S. Steel Corporation's iron-mining subsidiary in the Lake Superior district, has recently established a large laboratory in Duluth which is to work exclusively on the concentration of the low-grade ores of the district.

Bethlehem Steel Co. and Youngstown Sheet & Tube Co., through Pickands, Mather & Co. as their agents, have acquired large areas of Mesabi taconite lands and have been exploring them for several years. They also have a laboratory and test plant in operation at Hibbing. Bethlehem is also known to be active in Cuba, Chile, and Venezuela.

Republic Steel Corporation, the M. A. Hanna Co., and Jones & Laughlin Steel Corporation all have recently put large magnetic-concentration plants into operation in New York State. The ore treated is practically all mined underground and is then crushed, ground fine, and concentrated, and the concentrate sintered. M. A. Hanna has recently taken over the Evergreen Mines Co., in Minnesota, with large, low-grade ore properties on the Cuyuna and Mesabi ranges, and is also exploring iron-ore deposits in Labrador with the idea that this district may contain a new iron range. The company's new concentrator at Iron Mountain, Mo., is now in full production, the product going to furnaces in St. Louis.

Inland Steel has been investigating the Black River Falls magnetite deposits in Wisconsin, making large-scale experiments on the concentration of this material. The plan would be to ship sinter by rail to Chicago.

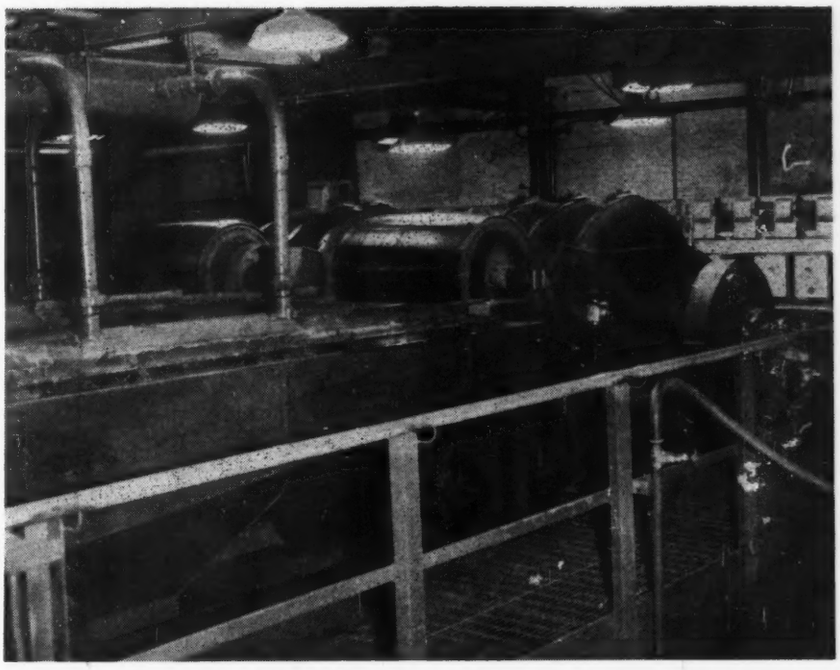
Algoma Steel Co., with its plant at Sault Ste. Marie, in Canada, has acquired a large area of low-grade magnetite ore at Goulais River and is actively exploring it and investigating concentration methods. In the past, the company has been securing much of its ore from the Mesabi.

Reserve Mining Co., subsidiary of Oglebay, Norton & Co., is actively working on magnetic taconites on the eastern Mesabi and has recently acquired water rights and tailing-disposal areas for a proposed 2½-million-ton concentrator.

Butler Brothers, the largest independent producer of iron ore in Minnesota, have a fine laboratory at Cooley and are actively at work developing better methods for concentrating their low-grade ores.

Cleveland-Cliffs have installed a new laboratory for work on the low-grade ores of Minnesota and Michigan and are investigating ore of the taconite type as well as more easily concentrated materials.

All of this activity certainly indicates that the steel industry is looking for new ore reserves; that the steel companies are concerned about the depletion of their open-pit reserves and are trying to determine the next best large source of supply.



STEFFENSEN FLOTATION MACHINES separating chalcopyrite-magnetite middling from magnetite concentrate in Bethlehem Steel Co., concentrator at Lebanon, Pa. This picture (of a portion of two of the six strings used on this work) shows the first permanent installation of these machines which were developed to fill a particular need.

An Important Question

Great tonnages of underground ore, low-grade ore, and especially taconite, exist in the Lake Superior district. These sources, as well as ores from other districts and from abroad, are being investigated, but until the uncertainties of national policies are removed, it is hardly to be expected that the ore-producing companies will commit themselves to any large program of expansion. Plenty of iron ore can be made available to our steel industries for generations of operation. The important question is from which source can great tonnages be secured regularly with the greatest certainty and from which steel can be made at the lowest cost. There is little hope that another Mesabi Range will be discovered adjacent to the Great Lakes, and for this reason concentration of the low-grade ores and the iron formations of the various districts are being given constantly increasing attention.

At the Concentrators

Minnesota. In this State, the attention given iron-ore concentration is divided between low-grade ores of the types that have been treated for many years, and taconite, the iron formation itself which is not as yet being treated commercially. Records of the Minnesota Tax Commission show only about 170 million tons of concentrates remain in the Minnesota mines, but this includes only those types now actually being

worked. Improvements in ore-handling and concentration methods will certainly make more concentrating ore available than is now reported.

For example, Butler Brothers, Cleveland Cliffs, Pickands, Mather; and M. A. Hanna have installed new equipment to recover more of the fine iron from their plant tailings. Flotation is being tried as well as several different gravity-type concentrating machines. If current tailings can be concentrated economically, millions of tons of similar tailings, produced during the past 30 years and deposited in tailing basins will become available. Flotation equipment is in continuous operation at three plants, double and even triple classification is being investigated, and new machines such as the Dorrco sizer, the Selective Media concentrator, the Hydrotator, and the Humphreys spiral are in use. At one plant, slimes are being removed, before flotation, with a Bird centrifugal classifier.

The sink-and-float process, introduced into the Iron Country a few years ago by Butler Brothers, is constantly being improved. The latest development is the use of a modified Akins classifier to replace the cones. Concentration of the –4-mesh material screened out of the feed sent to the sink-and-float plants continues a major problem.

A new plant is being built near Aurora, on the Mesabi, to produce pure iron powder from the slates that occur in the iron formation. It is being built by the State and is to be leased to Continental Machines Co., Inc., which will operate it as a pilot plant to demonstrate the commercial importance of the process originally developed at the University of Minnesota.

Eastern Districts Active

New York and New Jersey. There has been much activity in recent years in the concentration of the magnetites occurring in New York and New Jersey. Republic Steel Corporation is active in the former state at Mineville and Lyon Mountain. The new Fisher Hill plant, near the mines at Mineville, is in constant operation, but production has been curtailed on account of labor shortage underground. The original small, wet magnetic plant on the lake shore is not in operation. The same general flowsheet is used in the new plant as in the original wet plant, but the rod mills, Linney magnetic separators, and Dwight-Lloyd sintering machines are new. The plant at Lyon Mountain has been changed over almost completely to a wet concentrator, using equipment similar to that in use at Mineville. High-grade sinter can be produced at both of these plants, but a substantial proportion of the shipping product is coarse ore for open-hearth use.

The National Lead Co., at Tahawus, produces magnetic concentrate as a byproduct from its titanium recovery plant. New equipment is being experimented with to make a better separation of the iron and the titanium. This is now being done on tables and high-intensity magnetic separators.

Jones & Laughlin's plant at Benson and the M. A. Hanna plant at Clifton are in full operation, producing high-grade sintered magnetic concentrate. At both, labor shortages have interfered with production. At Clifton, most of the ore has been mined by open-pit methods, but a shaft has been sunk and will soon be supplying all of the ore to the mill. At both of these plants the ore is crushed and ground in ball-and-rod mills and concentrated on Crockett magnetic separators. Experimental operation of a martite-recovery unit at Benson will soon be under way.

A new concentrator has recently been put into operation at Mt. Hope, N. J., by Warren Foundry & Pipe Corporation, replacing the old plant. The ore contains magnetite, which is recovered in lump form on magnetic pulleys, and in finer concentrates by Davenport magnetic separators.

The Scrub Oak mine and wet magnetic concentrator of the Alan Wood Steel Co., near Dover, in the same district, are in operation, concentrating low-grade magnetite ore containing martite. The magnetite is recovered on Crockett magnetic separators and the martite on double-deck tables.

Outstanding Concentrator

Pennsylvania. Bethlehem Steel Co.'s concentrator at Lebanon is the principal producer of iron ore in Pennsylvania. It has been in operation for more than 30 years and normally produces 1 to 2 million tons of high-grade sinter annually. It is now equipped with the new Steffensen magnetic separators, followed by units that recover the copper, pyrite, and cobalt from the non-magnetic tailing.

A new concentrator was recently provided at the Scotia mine, at State College, Pa. This is a high-density plant, using a ferrosilicon medium. In design it is similar to the heavy-medium plants on the Mesabi. This property has not been in operation for some months and its final disposition is still to be determined.

Changes in South

Alabama. Washing of the brown ores of the Birmingham district has been in progress for many years, and from time to time the red ores have received attention. Not until a few years ago, when the Spaulding plant of Republic Steel Corporation was put into operation, did red-ore concentration become important in this district. More recently the Republic plant has been increased in size by addition of two new units. This plant has not been in full-capacity operation during the past year, on account of labor shortage underground. The ore is ground, classified, and tabled, and the concentrate sintered.

Recently Sloss-Sheffield has been installing equipment to determine the possibility of concentrating the red ores by magnetic roasting and magnetic concentration. In its pilot plant, crushed ore is fed to a specially designed rotary kiln in which it is heated and reduced to magnetite. The kiln product is ground in ball mills, concentrated magnetically, and the concentrate agglomerated in a rotary kiln. This operation will be watched with interest.

Missouri. M. A. Hanna & Co. is operating a new jigging plant at Iron Mountain, Mo. Here, –½-in. ore is treated on Conset jigs and the concentrate shipped to a blast furnace in St. Louis. The plant has been in operation during the past year, with satisfactory results. The ore has been mined by open-pit methods, but underground mining will begin shortly. This plant has a capacity of about 200,000 tons per year.

Texas. With the end of the war, interest in Texas iron mining seems to be declining. The Lone Star Steel Co. blast furnace at Daingerfield was never put into operation, although the iron-ore concentrating and calcining plant was operated for a time, the concentrate being shipped to Birmingham. Sheffield Steel had two small washing plants in operation during the war in the Texas district, but these have also been shut down. A certain amount of Texas ore has been, and probably will continue to be, used for making paint and oil well sludge.

NEW BOOKS

UNITS OF WEIGHTS AND MEASURES. By Walter Renton Ingalls. Published by American Institute of Weights and Measures, 33 Rector St., New York. Pp. 49.

Mr. Ingalls, chief editor of *Engineering and Mining Journal* from 1905 to 1919, then director of the American Bureau of Metal Statistics, in which capacity he still functions, has also been president, since its formation, of the Institute to which the publication of the pamphlet under review is ascribed. As Institute president he has long been ardently opposed to any efforts directed to making the use of the metric system of weights and measures compulsory in the United States as it has been in some other countries of the world. His attitude is naturally identical with that of his Institute, and this is set forth in the preface to his book. The Institute does not oppose the use of the metric system by anyone who finds it advantageous. But apparently few in the United States and Great Britain think the system worth while, because little use has been made of it in these countries although it has long been legal to do so. In trade with other countries, on neither side has demand for its use arisen. Despite their broad-minded attitude toward the metric system, however, neither Mr. Ingalls nor his Institute wishes to see the use of it grow in this country outside of scientific laboratories, where it is quite in order.

So much for background. The text of the pamphlet itself explains and describes, in the manner of a glossary, the nature and uses of some 50-odd units of measurement of the English system. Starting with the assay-ton of which every mining man knows, it ranges alphabetically through barrel, board foot, bottle, and B.t.u. to calorie, candlepower and carat; then to flask (of quicksilver), horsepower, jigger (of liquor), and knot, and so eventually to sheet metal gauges (and gauges for shotguns), ton and tun, wire gauges, and yard.

The pamphlet should be useful as well as interesting. A page or two in conclusion on conversion equivalents is inevitable. Among the isolated, possibly helpful, bits are the facts that the American nickel weighs 5 grams and that in estimating postage the ounce may be taken at 30 grams. In general, the task of conversion is rarely convenient, so we personally prefer to stick to one system as long as we can, which is the frame of mind doubtless that the author hoped to create—provided, of course, our preference be for the English system.

COLORIMETRY FOR CHEMISTS. By M. G. Mellon. Published by the G. Frederick Smith Chemical Co., 867 McKinley Ave., Columbus, Ohio. Pp. 133. Paper.

The author, who is professor of analytical chemistry at Purdue University, defines "colorimetry" as including "all procedures which have as their objective the evaluation of materials by means of some property related to color." The measurements divide themselves into those dealing with the determination of color as color, and with the determination or the amount (or both) of some desired constituent. Systems possessing color include gases, liquids, and solids. Analysts are familiar with the wide use of color for detecting constituents. Colorimetric methods of measurement have found their way into quantitative analysis increasingly in recent years. Analysts are most concerned with measuring the color of liquids, particularly solution, commonly measuring the transmittance or absorptance of light for this purpose.

No attempt is made to evaluate all the common methods of measuring color. The author considers such items as the cost of the equipment and its use, service facilities needed, the skill desired in the operator, the time required for a measurement, amount of sample needed, effect of measurement on the sample, preliminary treatment, sources of error, and the reliability of the results.

Six chapters suffice for the author's treatment of his subject, including the introduction. Chapter 2 deals with color stimulimeters, comprising additive instruments and subtractive instruments. In Chapter 3 he takes up color comparators, considering them under standard series instruments, duplication instruments, dilution instruments, and balancing instruments. Chapters 4 and 5 are devoted to absorbtometers. These include filter photometers comprising visual instruments and photoelectric instruments; and spectrophotometers, under which are treated photographic instruments, visual instruments, photoelectric instruments, and color analysis. Chapter 6 describes experiments in photometry. The book concludes with a bibliography of 251 items.

PUBLICATIONS RECEIVED

Simplified Spanish. A free pamphlet designed to facilitate self-instruction in the Spanish language. Lists 300 Spanish and English words of similar spelling, gives simple rules for changing endings of thousands of English words into Spanish words of similar meaning. Apply for free copy to Pan American Society, Box 315, Quito, Ecuador, S. A.

"Ferruginous Bauxite Deposits in Northwestern Oregon." Bulletin 39. Department of Geology and Mineral Industries, Portland, Ore. Pp. 98, plus a map of Hutchison-Nixon project. Price $1.

The following bulletins have been announced by the U. S. Geological Survey, Washington, D. C.

"Gold." Geological map and explanatory text on Comstock Lode district, western Nevada. Price 75c. On application to the Director.

"Alunite." Geological and development maps, with text, of Winkelman deposit near Marysvale, Utah. On request to tne Director.

"Talc." Geological map of the Gouverneur district, New York. Price 50c. On application to the Director.

"Beryl." Geological map and cross-sections of the Helen beryl pegmatite, Custer County, S. D. On request to the Director.

"Geological Survey of Eastern Maramma and Adjoining Areas, Western Kakamega, Northern Kavirondo." Report No. 8, Mining and Geological Department, Nairobi, Kenya Colony, Africa. Pp. 38, plus map. Price 2s.

"Quicksilver-Antimony Deposits of Huitzuco, Guerrero, Mexico." Bulletin 946-B. Pp. 49-71, plus 17 maps and sketches. Prepared in cooperation with the Mexican Government and with the U. S. Department of State. For sale by Superintendent of Documents, Washington, D. C. Price 75c.

The following pamphlets have been issued by the U. S. Bureau of Mines, Washington, D. C.:

R. I. 3830. Electrolytic Manganese in Acid-Steel Tests at Atlas Steel Casting Co. and the Detroit Steel Casting Co. Pp. 20.

R. I. 3832. A Study of Factors in the Hydrometallurgy and Electrodeposition of Cobalt. Pp. 43.

R. I. 3843. Suggested Methods for Installing Dust-Allaying Equipment in Bituminous-Coal Mines. Pp. 31.

R. I. 3813. Equilibrium in Reduction of Ferrous Chromite by Hydrogen and Energy Requirements in Selective Reduction of Iron in Chromite. Pp. 19.

R. I. 3814. Magnetometer Surveys on Black Sands of Oregon Coast. Pp. 18.

MARKET SUMMARY

THE LABOR CRISIS cast a deep shadow over all sections of the market for non-ferrous metals. Stoppage of work at the steel plants occurred on Jan. 21, and mine, mill, and smelters workers in the Salt Lake area called a strike on the same day, tying up operations at properties of Kennecott, American Smelting & Refining Co., and United States Smelting Refining & Mining Co., located in that territory. Workers at Mexican mines and smelters producing silver and silver-bearing metals went out on strike at the beginning of the month. Settlement of a strike at four plants of the American Zinc, Lead & Smelting Co. was a bit of good news.

Production at steel plants in this country dropped from 76.5 percent of capacity in the week beginning Jan. 14 to 4.9 percent a week later, the lowest rate in the history of the industry. Spokesmen for steel companies maintained the industry could not absorb an increase in wages of 18½c. an hour, suggested by President Truman, without a general upward revision in ceiling prices. Producers and fabricators of non-ferrous metals followed developments in this dispute with more than ordinary interest, holding that final settlement is certain to exert a strong influence on wage demands throughout industry.

Next of importance in the market was recognition by British authorities that bulk buying of major commodities would have to continue, even though price schedules of the war years had to be revised upward. The British Ministry of Supply purchased both Rhodesian and Canadian copper at the equivalent of the world price, contracts in most instances covering the first half of 1946. Shortly thereafter it was announced that the price of lead in the British market was raised £9 per long ton, establishing the official quotation at the equivalent of 7c. a pound, or one-half cent above the ceiling price in the United States market. The British also advanced 99.6 percent antimony to £125 per ton, a gain of £12 10s. Before January ended it was known here that the British Ministry of Supply purchased Special High Grade zinc from Canadian producers on the basis of 9c. delivered.

The RFC revealed on Jan. 29 that Metals Reserve has been instructed to renew its buying program for foreign copper, purchasing at the rate of 20,000 tons a month over the first half of 1946. It was stated that this tonnage is in

Major Metals

U. S. DAILY AND AVERAGE PRICES

1946 Jan.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25
31	11.775	11.700	52.000	6.50	6.35	8.25
AVERAGES FOR MONTH						
Jan.	11.775	11.700	52.000	6.50	6.35	8.25
AVERAGES FOR WEEK						
2	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25
CALENDAR WEEK AVERAGES						
Jan. 5	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.26
26	11.775	11.700	52.000	6.50	6.35	8.26

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(*a*) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(*b*) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1946 Jan.	Sterling Exchange: "Checks"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	Holiday	Holiday	Holiday	Holiday	Holiday
2	403.000	70.750	44d.	172s. 3d.	$35.000
3	403.000	70.750	44d.	172s. 3d.	35.000
4	403.000	70.750	44d.	172s. 3d.	35.000
5	403.000	(e)	(e)	(e)	35.000
7	403.000	70.750	44d.	172s. 3d.	35.000
8	403.000	70.750	44d.	172s. 3d.	35.000
9	403.000	70.750	44d.	172s. 3d.	35.000
10	403.000	70.750	44d.	172s. 3d.	35.000
11	403.000	70.750	44d.	172s. 3d.	35.000
12	403.000	(e)	(e)	(e)	35.000
14	403.000	70.750	44d.	172s. 3d.	35.000
15	403.000	70.750	44d.	172s. 3d.	35.000
16	403.000	70.750	44d.	172s. 3d.	35.000
17	403.000	70.750	44d.	172s. 3d.	35.000
18	403.000	70.750	44d.	172s. 3d.	35.000
19	403.000	(e)	(e)	(e)	35.000
21	403.000	70.750	44d.	172s. 3d.	35.000
22	403.000	70.750	44d.	172s. 3d.	35.000
23	403.000	70.750	44d.	172s. 3d.	35.000
24	403.000	70.750	44d.	172s. 3d.	35.000
25	403.000	70.750	44d.	172s. 3d.	35.000
26	403.000	(e)	(e)	(e)	35.000
28	403.000	70.750	44d.	172s. 3d.	35.000
29	403.000	70.750	44d.	172s. 3d.	35.000
30	403.000	70.750	44d.	172s. 3d.	35.000
31	403.000	70.750	44d.	172s. 3d.	35.000
AVERAGES FOR MONTH					
Jan.	403.000	70.750	44d.	—	35.000
AVERAGES FOR WEEK					
2	403.000	70.750	—	—	
9	403.000	70.750	—	—	
16	403.000	70.750	—	—	
23	403.000	70.750	—	—	
30	403.000	70.750	—	—	

Calendar week averages, New York Silver, Jan. 5th, 70.750; 12th, 70.750; 19th, 70.750; 26th, 70.750.

(e) Not quoted (Saturday).

(*c*) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotation on newly-mined domestic silver 999 fine was 70⅝c. throughout January.

London silver in pence per troy ounce.

(*d*) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

addition to commitments presently outstanding. Terms of sale are believed to be unchanged. The foreign market for copper was firm as January ended.

Supply of lead continues to shrink. At a meeting of the advisory committee, CPA officials were informed by industry leaders that nothing short of an upward revision of the ceiling price of lead would correct the supply-demand picture. It was argued that a price of 8c. would bring out increased production at the mines, step up recovery of lead scrap, and curb excessive buying. Up to the last day of the month there was no official word from Washington on whether the ceiling price of lead will be revised or not. However, Director Snyder of OWMR declared that supplies of lead from all sources in 1946 will be below peak levels and a proportion of the demand will not be satisfied.

British purchases of zinc in Canada had a beneficial influence on the zinc market here.

Effective Feb. 1, consumers of cadmium may not use more than 90 percent of the amount they used in 1941.

Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for December and January:

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

	Dec.	Jan.
Quicksilver, N. Y. flask	108.000	104.808
Antimony (a)	15.839	15.839
Antimony, bulk, Laredo	14.500	14.500
Antimony, bulk, N. Y.	15.265	15.265
Antimony, Chinese (b)	16.500	16.500
Platinum, oz. troy	35.000	35.000
Cadmium (c)	90.000	90.000
Cadmium (d)	92.500	92.500
Cadmium (e)	95.000	95.000
Aluminum ingot	15.000	15.000

E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929	110.33	1937	90.86
1930	82.87	1938	73.67
1931	60.20	1939	77.71
1932	48.26	1940	79.22
1933	59.79	1941	83.49
1934	65.59	1942	86.80
1935	74.66	1943	88.74
1936	73.45	1944	88.74
		1954	90.86

	1944	1945	1946
January	88.74	88.74	96.42
February	88.74	88.74	....
March	88.74	88.74	....
April	88.74	88.74	....
May	88.74	88.74	....
June	88.74	88.74	....
July	88.74	88.74	....
August	88.74	88.74	....
September	88.74	91.16	....
October	88.74	96.40	....
November	88.74	96.42	....
December	88.74	96.42	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(Feb. 1, 1946)

Aluminum, ingot, 99 plus per cent, lb.	15c.
Antimony, domestic, spot, lb., 5 tons or more	15.839c.
Bismuth, ton lots, lb.	$1.25
Cadmium, commercial sticks, lb.	90c.
Calcium, lb., ton lots, 97 @ 98 per cent, cast	$1.85
Chromium, 97 per cent grade, lb.	89c.
Cobalt, 97 to 99 per cent, per lb.	$1.50
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation) troy oz.	$35.00
Quicksilver, flask of 76 lb., 25 flasks or more	$103.00
Selenium, 99.5 per cent, lb.	$1.75
Silicon, minimum 97 per cent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50 nom.
Titanium, 96 to 98 per cent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit	$8.00@$10.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.95
Mesabi bessemer	$4.70
Old Range non-bessemer	$4.80
Mesabi, non-bessemer	$4.55
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.01
Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 per cent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 60 per cent, duty paid	$24.00
Domestic, 60 per cent and upward	$24.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton. (a) Prices at mines, small lots, normally several dollars less.	$50.00

METALLIC COMPOUNDS

Arsenic Oxide (arsenic) lb.	4c.
Cobalt Oxide, 70 @ 71 per cent, lb.	$1.06
Copper Sulphate, 100 lb.	$5.00

ALLOYS

Beryllium Copper, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent per lb. of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum, 55 @ 65 per cent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 per cent, per lb. of contained Si	6.60@8.10c.
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V delivered	$2.70@$2.90
Silicomanganese, 1 per cent C, gross ton	$138.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$8.50@$9.00
Missouri, 93 to 94 per cent $BaSO_4$, per short ton	$8.25@$8.50
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 per cent, all rail movement, ton	$30.00
Acid 98 and ... per cent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica — Colonial Mica Corp., agent for Metals Reserve Co., quoted full-trimmed ruby muscovite domestic, April 1 to Sept. 30, inclusive — No. 1, $1.70 to $36.65 per lb., depending on size; No. 2, $1.25 to $26.00; No. 2 Inferior, 50c. to $16.00; No. 3, 25c. to $6.25. Prices f.o.b. nearest producer's rifting plant. Current quotations nominal.	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$25.25
Steel, base price, Pittsburgh Billets, gross ton	$36.00
Structural shapes, 100 lb.	$2.10

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Wrather Sees Hope for Discovering Hidden Ores

With the prediction that "in a land of such wide diversity and size as the United States, we will eventually come to realize that great mineral resources remain to be developed," W. E. Wrather, director of the U. S. Geological Survey, placed himself and his organization behind the idea that ingenuity in exploration for hidden orebodies was the answer to wartime depletion of our mineral reserves. The occasion was the annual meeting of the Colorado Mining Association held at Denver on Jan. 25. In this talk, the head of the Geological Survey made the most optimistic statement heard in years regarding possibilities for the discovery of new orebodies.

Current estimates of the reserves of high-grade iron ore or the ores of copper, lead, and zinc are not cause for complacency, according to the director. We cannot pin our hopes on the development of improved mining, milling, and smelting techniques that will permit exploitation of lower and lower grade ores. A more thorough understanding of geological processes and conditions, supplemented by appropriate geophysical techniques, should enable the discovery of orebodies "in places where, on the basis of surface evidence alone, there is no reason to suspect their existence."

The oil industry, faced with similar conditions 25 years ago, had to overcome the problems of depleted reserves which mining people face today. The industry recruited geologists to locate and map deep-seated structures that had escaped previous discovery. These men turned to certain geophysical methods and scientific equipment which promised to reveal subsurface conditions. Their work resulted in the phenomenal petroleum discoveries of the 1930's, without which the Allied mechanized war machine could not have functioned in the second World War.

"Ore is where you find it, of course, but tomorrow's high-grade ore exists today in imagination only. It will be found only by the exercise of all the wit and ingenuity that can be conjured up by the combined scientific and practical talents of the industry. The Geological Survey is unwilling to accept the discovery rate of recent years as a gage of our future expectancy."

Individual companies cannot be expected to carry the load of the basic research which would benefit the entire country. Neither should the mining industry as a whole be expected to absorb the expense where the national welfare is so vitally involved, reasoned Dr. Wrather.

"The mining industry should and can expect the Federal Government to be sympathetically and actively cooperative in seeking the discovery of more adequate mineral reserves. It is the responsibility of private industry, however, to give serious thought and advice in planning and sponsoring the program, and it is its prerogative to insist that the job be done as effectively and economically as circumstances permit. The Geological Survey is willing and anxious to conduct basic investigations that should clarify the problems of ore genesis and deposition and thus pave the way for successful exploration. If enough serious effort can be applied to the job, I am willing to predict that reasonably reliable forecasts can be made of the location of ore deposits that have thus far escaped discovery."

Contract Termination Act May Afford Relief

An amendment to the Contract Termination Act is in the offing which will give relief to mine operators in similar degree to that provided in the Minerals Relief Act of 1919, according to the sponsors of the new measure.

The proposal is to protect against loss the mines, mills, and smelters of any metal declared to have been critical by the Army-Navy Munitions Board during the National Emergency, "if the operation was undertaken or continued in good faith in response to any verbal, written or published request, demand, solicitation, or appeal, or any act of stimulation, by the President, the Congress, or by any other official, agency, or corporation of the Government, or duly appointed agent thereof, whose functions, at the time, were connected directly or indirectly with the production or acquisition of any such mineral or metal in connection with the national defense, the conduct of war, or essential civilian supply."

The proposed amendment goes on to provide for the appointment of examiners by the director. The duties of the examiners in determining the net loss of the claimants are set forth together with a list of subjects which are given consideration in computing the net loss. Provision is included for appeal to the courts and for arbitration.

Last but not least, the proposed legislation would give Congress, through any Government agency, the right to reopen any claim and recover any money of which the Government was defrauded, "even to the third and fourth generation." However, the practical value of such a provision is open to serious doubt.

Leadville Tunnel Omitted From Appropriation Bill

The Leadville tunnel is no nearer completion than ever, though the usual procedure has been followed. When the Department of the Interior appropriation bill was being considered, the House did not provide for the project. The Senate included the item when the bill reached the upper chamber. In conference the House conferees kicked the item out again.

The history of the appropriation for the Department of the Interior can be told in a few short words. The House cut the appropriation 50 percent below the figure submitted. Generally speaking, the amounts were restored in conference to 75 percent.

All special projects such as the Leadville tunnel were hit hard. In all, 283 amendments were offered by members of the Senate. With the exception of those relating to power, few of these amendments got anywhere.

Labor Mess Requires Face-Saving Device

Labor legislation and economic stabilization appeared to be the first order of business as Congress reconvened after its holiday recess. It is all one problem. Government policy is that labor must receive high wages. This policy is supported widely throughout the Administration but for different reasons. The Secretary of the Treasury is for high wages because the greatest public debt in all history must be liquidated. The Secretary of Commerce, Henry Wallace, is the apostle of the common man. On the other hand, high wages are opposed by Chester Bowles, of OPA, if higher wages means higher prices.

The outlook in mid-January was that the Administration favored a recession from the strict "hold-the-line" policy it has pursued in the past. It is believed that Mr. Truman will talk the matter over with the congressmen and that his high wage policy will prevail over the views expressed by Mr. Bowles.

The President's urgent request for fact-finding legislation put it at the head of the legislative list, but there was no early indication that Congress would move rapidly. It appeared more likely that Congress would delay action until the report of the President's fact-find-

ing board in the General Motors case showed clearly defined results.

When the United Automobile workers made their demands on General Motors, union leaders followed their usual practice of demanding twice what they expected to get. After going too far to retreat, they discovered there was no War Labor Board to tell them that the union could not have the demanded 30 percent increase in wages. There was no agency in the Government with the power to deny the union and permit the union officials to save face while backing down. Union officials definitely were on the hook until the President appointed the fact-finding board. This explains the alacrity with which the suggestion of the board was accepted by the union, even though the union came out strongly against the board when it was first appointed. Many important Government officials in the labor relations field believe some agency that can take the rap and save face for every one is a necessity.

Hearings Held on Gold Mine Compensation Bill

Next real test for legislation to give relief to gold mines closed by order L-208 will come when the House votes on H. R. 4393, the bill sponsored by Congressman Engle, of California. Hearings on the measure were resumed the first week in February. No difficulty was expected or encountered in committee. The hearings were drawn out to complete the record so that the issue would be clear. Backers of the legislation took pains to show that no other order of a Government agency was like L-208. Many regulations hurt individual operators or even whole segments of other industries. In contrast, the whole gold-mining industry was closed by L-208. Unless this can be clearly established, the bill has no chance of passing when the vote is taken in the House sometime late in February or in March.

The testimony of Dr. Wilbur Nelson on the first day of the hearings before the House Committee on War Claims was that Order L-208 was not justified. Dr. Nelson explained that it had been shown by the industry and Government officials that the object of getting more men for the base-metal mines could not be reached by closing the gold mines. The War Department forced the issue, basing its arguments on misinformation from other sources.

During the testimony of Dr. Nelson, who headed WPB's mining equipment division when L-208 was issued in October 1942, it was brought out that gold mines of other countries continued to be furnished machinery and supplies throughout the war period. Foreign operators were supplied from this country with equipment denied to domestic gold producers.

The same bill introduced in the Senate by Senator Murray for himself and Senators Hayden, McFarland, and Taylor has been tabled indefinitely by the Senate Committee on Claims. This means that unless Congressman Engle is successful in the House the legislation is dead.

Lead Workers Criticize CPA Supply Policies

Labor, which is the only group in the lead industry that had not seriously criticized the work of the Tin-Lead-Zinc Branch of CPA, threw its share of brickbats in mid-January. The National Council of Battery Workers, in an open letter to the President, proposed that the control of lead be taken from CPA and be given to another agency to be established in the Office of War Mobilization and Reconversion. The union suggested incompetence and negligence in handling problems resulting from the present lead shortage. It also was charged that "the impending crisis has been seen for over a year, yet CPA has taken no effective steps to forestall it."

A five-step program was included in the union blast against the officials now handling lead. The first point in the program was a call for recruiting 4,000 more mine workers, and adding that working conditions and pay should be improved to a point that work in the lead mines would be attractive to returning veterans and to former miners who had left the camps for better-paying war jobs.

For a long time it has been recognized that shortage of labor was the biggest detriment to the increase of lead production. For the last two or three years, the Government has been carrying on a recruiting program without conspicuous success. Every possible Government agency has been brought into the picture. The lead mines have had the benefit of the highest labor priorities and there still remains a shortage of men in the mines of about 4,000. It is important to note that the addition of 4,000 to the labor force in the mines would bring out about 50,000 tons annually at most. This is a mere drop in the bucket, compared to the tremendous demand.

A subsidy on the production of secondary lead proposed by the union is impossible to administer, in the opinion of officials familiar with the scrap-lead business.

The union suggestion that aluminum be substituted for lead in the manufacture of foil and collapsible tubes is impractical. The amount of lead being used for foil at present is negligible. Aluminum could not be used on the machines making lead tubes. Aluminum requires much heavier equipment. It was also suggested that titanium be substituted for lead in the manufacture of paint. Titanium pigments are being made to the extent that titanium dioxide is available. Fact is that TiO_2 is very short. The difficulty does not lie in a shortage of ilmenite but rather is to be attributed to a lack of facilities to produce titanium dioxide, which cannot be remedied until new facilities are built. Just when the building will go forward is a question, although special priorities have been issued for the projects of at least two companies.

Lead hoarding, which was suggested by the union as a field for the Government to check, has not been a source of trouble. There is some hoarding, no doubt, but the inventory controls instituted during the war have been successful to the extent that hoarding is not a serious consideration at this time.

The union also proposed that increased quantities of lead be allocated to the manufacturers of batteries to prevent lay-offs in the storage-battery plants. The figures show that lead has been allocated from the stockpile and that the rate has been so rapid that the stocks will be exhausted within three months if the present rate is maintained.

Washington views the blast of the National Council of Battery Workers as just another case of an industry saying you can't do this to me but it is all right to do whatever you want to some one else, in this case the men making collapsible tubes, paint, or some other item in which lead is used. The only difference is that in this instance the squawk comes from labor rather than management.

Government officials say that it can be freely predicted that lead will be in short supply on a worldwide scale for years. At present there is a shortage of men in the mines and of developed ore in the mines, both a result of the war. The only chance to relieve the situation is by new discoveries or a higher price for lead.

Cadmium Shortage Causes New Allocation Program

Cadmium has been placed under modified control by CPA with distribution based upon a percentage of use in 1941. The situation is due to a sharp increase in demand on the one hand and a lack of production on the other. Activity in the zinc industry, of which cadmium is a by-product, has fallen off due to strikes and labor shortages at the smelters. Production of cadmium has remained constant in the face of rising demands.

The cadmium production rate reported by CPA at the time the industry was called in to discuss the possibility of restoring distribution controls is 7,200,000 lb. per year. Consumption has been at a rate exceeding 8,000,000 lb. a year. Government stocks declined from 1,261,300 lb. on July 1, 1945, to 846.300 lb. on Jan. 1, 1946. Unless controls are imposed, the present consumption rate of cadmium will exhaust the Government stockpile in less than a year, according to CPA estimates.

NEWS OF THE INDUSTRY

Bids for Geneva Plant To Be Opened April 1

Bids for the purchase or lease of the surplus $200,000,000 Government-owned steel plant at Geneva, Utah, will be opened on April 1, instead of March 1, as previously announced, according to an order made public by Lieut.-Gen. Edmund B. Gregory, chairman of the board of War Assets Administration, on Jan. 21.

It is reported that the 30-day extension was ordered because of unstable conditions in the steel industry which had held up full consideration by interested companies. The property includes, in addition to the steel plant, coal mines at Columbia, iron ore mine facilities at Cedar City, and quarry facilities at Payson, all in Utah. It has been reported that Henry J. Kaiser plans to form a syndicate to negotiate leasing the property, with option to buy.

Alcoa Grants U. S. Free Use of Aluminum Patents

The Aluminum Company of America has agreed to grant the Government free use of its patents for the production of aluminum. This action, announced by Surplus Property Administrator W. Stuart Symington on Jan. 10, removed the last obstacle to acceptance of the offer of Reynolds Metals Co. to lease the Hurricane Creek and Jones Mill plants from RFC.

Mr. Symington said the agreement involved no understanding by which the Department of Justice would modify its monopoly charges against Alcoa. Tom C. Clark, Attorney General, hailed the move as a substantial contribution to the establishment of real competition in the aluminum industry and as "entirely in line" with the objectives of the anti-trust suit.

Arthur V. Davis, president of the Aluminum Company of America, in a letter to Mr. Symington, said:

"Except for the public considerations which you have presented to us so effectively, we would not consider a royalty-free license under such a valuable asset. However, we are glad to accede to these considerations, and if by so doing we have contributed in any substantial way to the solution of the complex problems of surplus property disposal confronting the Congress, the Surplus Property Administration and other governmental agencies, we are well repaid."

Mr. Symington, replying to Mr. Davis, wrote:

"If in the past I have had occasion to be critical of the Aluminum Company of America, today's action on your part demonstrates to my complete satisfaction that your company, no less than the Government agencies concerned, is moving constructively toward the solution of problems which confront the Surplus Property Administration, the aluminum industry, and the country as a whole."

The Reynolds Metals Co. announced that it will take over the two plants immediately. The lease of the Hurricane Creek and Jones Mill properties is on a straight commercial basis, with no subsidy of any sort involved, the company declared. The lease runs for five years and contains an extension clause and a purchase option.

A.S.&R. Acquires Interest In Granby Consolidated

The American Smelting & Refining Co. has acquired a substantial minority interest in Granby Consolidated Mining, Smelting & Power Co., Ltd., according to an announcement recently by Julian B. Beaty, president of Granby. The block of stock acquired was that of the Amster Estates' holdings. As a consequence of the sale, James Amster has retired from the Granby board. Samuel L. Fuller also resigned as Granby director. Kenneth C. Brownell, vice president, and John C. Emison, treasurer, of A.S.&R., have been elected directors of Granby Consolidated.

Granby Consolidated is engaged chiefly in copper mining in British Columbia, and for several years has been shipping copper to the Tacoma smelter of A.S.&R.

Utah Copper Workers Go Out on Strike

More than 5,000 mine, mill, and smelter workers went on a strike in Utah Jan. 21 against Utah Copper Co.; United States Smelting, Refining & Mining Co., and American Smelting & Refining Co.

A vote authorizing the strike, which had been approved by district locals of the International Union of Mine, Mill & Smelter Workers, was announced Nov. 15, 1945, by the National Labor Relations Board. Reid Robinson, president of the international union, met with the policy committee which set the date of the strike, and announced it on Jan. 3. Union representatives asked for equal pay with wage scales in the Coeur d'Alene district in Idaho.

In a reply to the union's notice of intention to strike, D. D. Moffat, president and general manager of Utah Copper Co., said the union's demand for a wage increase was not justified because increases which already had been granted employees represented by the union since Jan. 1, 1941, had resulted in increased income to them averaging 43 percent, based on a 48-hour week. The employees have actually worked 48 hours, he said, but have been paid for 52 hours.

"We do not believe in the theory that wages should be equal in the various mining areas, since living and working conditions are much different," Mr. Moffat continued. "This is especially true in comparing the Coeur d'Alene area, where wage rates in mining operations always have been higher than in the Salt Lake area. The Arizona mining area, where generally wage rates always have been lower than in Salt Lake area, might just as well be taken as a comparison, but likewise living and working conditions are not comparable." Mr. Moffat suggested that the present wage scale and a 48-hour week be continued until June 30, this year.

NEWS BRIEFS

Mining Congress Meeting. The Metal Mining Convention and Exposition of the American Mining Congress will be held in the City Auditorium, Denver, Colo., Sept. 9 to 12.

Crater Not Formed by Meteor. Arizona's famous crater was not formed by impact of an enormous meteor, maintained Dr. N. H. Darton, of U.S.G.S., at a recent annual meeting of the Geological Society of America. Dr. Darton believes that the crater is the result of a steam explosion, and for supporting evidence points out that a similar but smaller one lies 120 miles to the east which has a cinder cone in its center. More than $1,500,000 has been spent in search for a buried meteor, but none has been found.

Uranium Mine Inspection. Jan Masaryk, Czechoslovak Foreign Minister, told the Assembly of United Nations in London that no Czechoslovak uranium will be used for destructive purposes and expressed the opinion that output from uranium mines should be open to international inspection.

Colombian Coins Debased. Silver content of 10c, 20c, 50c, and one peso coins will be reduced. The former ratio of 900 parts of silver to 100 parts of alloy will be reduced to 500 to 100 by authority of the Minister of Finance.

Dominion Bureau Reports Canada's Metal Production

Metal production in Canada during 1944 and 1945, according to preliminary figures issued by the Dominion Bureau of Statistics:

	1944	1945(c)
Antimony, lb.	1,937,933	1,680,000
Arsenic (As_2O_3), lb.	2,627,022	2,030,471
Bismuth, lb.	123,875	210,000
Cadmium, lb.	526,970	637,000
Calcium, lb.	.....	29,543
Chromite, ton	27,054	5,662
Cobalt, lb.	36,283	109,123
Copper, lb.	547,070,118	476,284,746
Gold, fine, oz.	2,922,911	2,661,567
Iron ore, ton	553,252	1,134,808
Lead, lb.	304,582,198	345,455,080
Magnesium, lb.	10,579,778	7,449,367
	1944	1945(c
Mercury, lb.	735,908	.....
Molybdenite concentrates, lb.	2,127,508	976,160
Nickel, lb.	274,598,629	243,956,502
Palladium, rhodium, iridium, etc., fine oz.	42,929	155,600
Platinum, fine oz.	157,523	162,000
Pitchblende products (a)	(b)	(b)
Selenium, lb.	298,592	419,000
Silver, fine oz.	13,627,109	12,866,597
Tellurium, lb.	10,661	42,000
Thallium, lb.	128	.....
Tin, lb.	516,626	850,000
Titanium ore, ton	33,973	13,306
Tungsten concentrates, lb.	886,745	.....
Zinc, lb.	550,823,353	509,638,004

(a) Uranium, etc. (b) Not available for publication. (c) Preliminary.

War Department Announces Policy on Overseas Scrap

War Department policy on return of overseas junk and scrap was announced last week.

Lead- and tin-bearing scrap will be brought back to help ease shortages in the United States. Copper and brass scrap will be returned from all overseas commands except France, Belgium, England, and the Netherlands.

Most aluminum scrap will be sold to foreign countries. Some aluminum may be processed in Germany and returned in the form of ingots.

The Army will not bring back iron scrap from anywhere but Germany, except where it can be used as ship ballast.

Louis Cates Opposes Reduced Copper Tariff

During a recent inspection tour of Arizona properties of the Phelps Dodge Corporation, Louis Cates, president, commented that prospects for the copper industry were bright and that a good demand will warrant capacity production at Arizona mines for at least three to four years. He called attention, however, to the competitive threats posed by Canadian production of 30,000 tons of copper per month as a byproduct of nickel and gold production, adding that anything the Canadian producers get for it is profit. "This production is tributary to the Detroit-Chicago area," he stated, "where the consumption is large and they (Canadian producers) have further advantage of low freight costs." Huge production in South Africa and South America, where labor costs are very low, must also be reckoned with, he pointed out.

"It is very important that the four-cent copper tariff be retained." Mr. Cates summarized, and called attention to such current threats to the tariff as the President's power to cut it to two cents, and the favored nation clause in the good-neighbor pacts which must be watched continuously.

Prewar Tin Production Improbable Before 1948

The preliminary report of the United States Tin Mission, recently returned from the Far East, indicates that damage by the Japanese to the tin dredges in British Malaya was much less than expected but that the prewar rate of production will probably not be approached until 1948.

The Mission, representing the U. S. Commercial Co., subsidiary of the Reconstruction Finance Corporation, included Arthur Notman and Charles Slaughter, who saw government and military officials and inspected some 40 tin dredges. According to the Mission, there was no evidence of any systematic effort by the Japs to wreck the dredges or render them useless, though most dredges are temporarily out of operation due to a petty thievery of essential parts. The most serious obstacles to renewed production are the poor condition of dredges, due to operation by the Japanese without normal repairs or replacements, the poor location of many dredges because of unscientific dredging operations by the Japanese, and unsettled economic conditions in the country. Some of these conditions are the natural result of Japanese military occupation, but they are complicated by shortage of motor vehicles and shortage of food and consumer goods for the workers. On the favorable side, the dredging companies see no difficulty in rerouting such labor if food can be obtained. Shipping is adequate, and tin smelters were found to be in good condition. The Mission agreed with estimates of mining companies that production in 1946 will be only a fraction of normal but will thereafter improve rapidly, reaching close to the prewar figure in the year stated.

According to the RFC, stocks of tin metal amounting to some 4,500 tons have so far been located in Malaya and about the same quantity in Siam. The disposition of this metal is being considered by the Tin Committee of the Combined Resources Materials Board sitting in Washington. It is also known that there are certain stocks of concentrates in those countries, but no reliable estimate could be obtained as to their amount at the time of the Mission's visit.

"Have-Not" Status of Industry Is Refuted At Colorado Mining Association Meeting

Members Urged to Back Up Legislation Favorable to Industry—Gold, Silver, Sound Money Policies Discussed

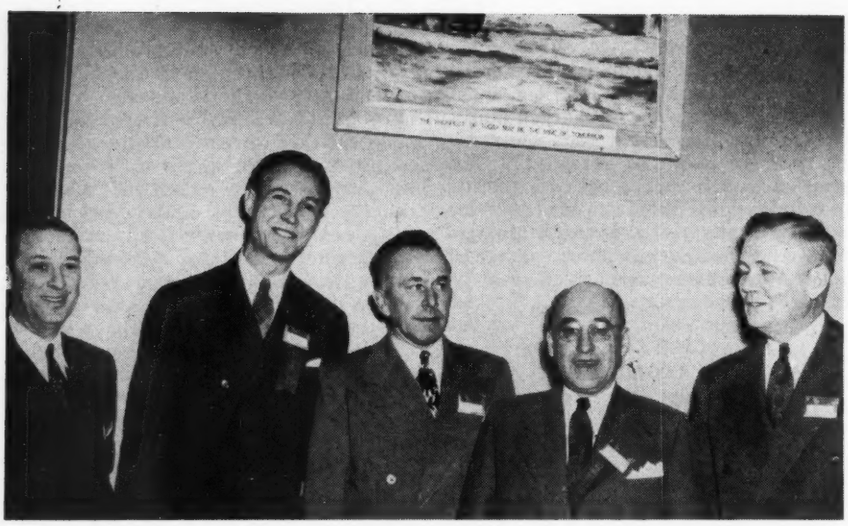
Debate between "have" and "have-not" schools of thought as to the mineral resources of the U. S. continued unabated at the 49th annual meeting of the Colorado Mining Association in Denver, Jan. 24 to 28, with which was combined a general Mineral Resources Conference. Representatives of the Western mining industry upheld the thesis that there is an abundance of mineral wealth yet to be discovered with better exploration methods and proper incentives. A feature of the convention was insistence that all the mineral extracting industries must stand together to attain proper legislative ends in Washington. The convention went on record as opposing any extension of practices that would tend further to withdraw public lands from private development; and against extension of the mineral leasing system.

The Colorado Mining Association was host to State resources officials from all states west of Michigan, who in a symposium uniformly gave a more cheerful picture of state mineral resources than do federal officials. Resolutions of the policy committee of the Mineral Resources Conference, formed a year ago by officials of CMA, expressed the view that:

"It will best service the public interest to maintain a policy that will foster domestic mineral production...and discovery...by continued extraction of large known marginal deposits of ore in present mines, which if not extracted now may be forever lost. Such production may be placed in a national stockpile."

Stockpiling Approved

Sentiment was on the whole favorable to the stockpiling bill now before the House, although Robert S. Palmer, Executive Secretary of Colorado Mining Association, declared the industry should take care lest "an internationalist with connections throughout the world" be named chairman of the stock-



Left to right: B. T. Poxson, first vice president, Colorado Mining Association; Robert S. Palmer, executive secretary; C. J. Abrams, second vice president; Harvey L. Tedrow, president; and R. M. Hardy, of the Sunshine Mining Co., Kellogg, Idaho.

Left to right: Carl H. Wilken, Washington economist; Charles N. Bell, past president of Colorado Mining Association; Arthur Yahn, St. Louis Smelting & Refining Co.; Le Roy Burkett, a convention director; and H. S. Worcester, Telluride Mines, Inc.

piling committee and take action adverse to the domestic industry. Sentiment adverse to any further lowering of tariffs on minerals was also expressed.

The resolutions were adopted after the convention listened to Elmer Pehrson, chief of the Economics and Statistics Branch of the U. S. Bureau of Mines, and Director William E. Wrather of the U. S. Geological Survey.

Mr. Wrather took a much more optimistic view of the U. S. mineral reserves than Mr. Pehrson, declaring that improved exploration and extraction methods could be counted on to find and make use of reserves not visible from the surface. He cited the example of the oil industry, which, he declared, 20 years ago was in the position regarding reserves in which other mineral industries now find themselves. Mr. Pehrson reviewed the figures as to mineral reserves he first presented in 1945, and predicted a "strong import status" for lead and zinc almost immediately, and for copper within ten years. He declared for a five-year "moratorium" on further tariff changes.

Incentive Plan Pays

E. H. Snyder, president of Combined Metals Reduction Co., of Salt Lake City, said that mines of this company had produced ten times as much as original estimated reserves indicated, and expressed belief that some such ratio of production to proved reserves could be achieved in many other instances. He and other speakers said the continuing manpower shortage had more to do with the decline in production, as noted by Pehrson, than any lack of mineral resources.

Charles F. Parks, Jr., chief of the Metals Section of the Geological Survey, said that the objectives of the survey's work are to cooperate with private industry in the exploration for mineral deposits required in the future.

Professor Philip Bucky, of Columbia University, declared the industry must aim at more efficient operation, including the use of long-hole drilling and the handling of much larger rock fragments underground, perhaps as large as six feet. Victor Rakowsky, of Joplin, Mo., pointed out the increasing value of heavy-media separation processes in handling low-value ore.

F. O. Davis, of the Potash Company of America, said that the incentive-payment plans of the potash companies operating in New Mexico had largely increased production without increasing overhead—19 percent over the last 12 months in the case of his own company. Most important feature of such a plan, he said, is never to cut the incentive rate because workers are making good returns.

Lead and Zinc Discussed

Robert S. Lewis, professor of mining at the University of Utah, told of experiments which indicate that the airflow through tunnels and shafts may be increased as much as 29 percent by streamlining the faces of timbers opposing the airflow.

James A. White, of Washington, reviewing the status of silver legislation, said that in his opinion if the Green bill is passed (providing for the sale of Treasury silver to users at 71.11c. per ounce) it will tend to put a permanent ceiling at 71.11c. per ounce on silver and will subsidize silver users at the expense of silver producers.

Harold Glasser, of the division of monetary research of the U. S. Treasury Department, said that the world supply of gold is too badly adjusted for gold ever again to attain a formal relationship to monetary systems, and that gold must continue to be subject to national control and use, rather than "going into woolen socks and safety deposit boxes."

George Heikes, of Ventures, Ltd., read a paper prepared by Felix Wormser, of the Lead Industries Association, which declared that present prospects are for a continued million-ton consumption of lead yearly in the U. S. and that with domestic production at around 400,000 tons, the remainder must be made up from imports and the use of scrap.

Otto Herres, vice-president of Combined Metals Reduction Co., led off the discussion of zinc by declaring it behooves the industry to see that pledges against further tariff reductions on zinc (given when Congress gave the President the power to cut tariff rates further) are honored, and added that

restoration of a free market for zinc, and lifting of government controls in general, would provide the main incentive toward greater production. Other speakers foresaw an active and useful future for the zinc industry, but called for stockpiling administered in such a way as to protect the domestic industry. O. W. Bilharz, representing Tri-State lead and zinc ore producers, said, however, that cessation of the premium price plan would be disastrous to Tri-State mines.

The theme that the metal-producing industries generally should be more active and articulate in backing up demands for favorable legislation was emphasized by several speakers, including particularly Representative Clair Engle, of California, who said that establishing a free market in gold would be the preferable way of insuring gold miners an adequate return, as against a flat price increase or a subsidy to U. S. producers.

Green Bill Opposed

Orval W. Adams, executive vice-president of Utah State National Bank and a former president of the American Bankers Association, presented a nine-point plan for a return to Government solvency, including a balanced budget and a return to the gold standard.

Senator Pat McCarran, of Nevada, pledged that he and other Western Senators would filibuster if necessary to defeat such legislation as the Green bill. He and other speakers took the view that unless a prompt return is made to "sound money," the fate of civilization hangs in the balance.

In introducing D. Worth Clark, former U. S. Senator from Idaho, Mr. Palmer declared that he had "hoped to introduce Senator Clark as the new Secretary of the Interior, but unfortunately another man still holds that position." Senator Clark declared for a "dynamic" stockpiling policy that would seek out new reserves and protect producers, rather than for the "static" one he said is favored by advocates of the "have-not" theory. Particularly, he said, mining men should work toward implementation of the expressed purposes of the Silver Act of 1934—to buy domestically mined silver at $1.29 an ounce until the total Treasury stocks equal one-quarter of the combined holdings of silver and gold.

Attendance was the largest in history, with more than 1,500 present at the Silver and Gold banquet.

Officers re-elected for the coming year were: president, Harvey L. Tedrow, Cripple Creek; first vice president, B. T. Poxson, Denver; second vice president, C. J. Abrams, Climax; third vice president, Merrill E. Shoup, Colorado Springs; fourth vice president, John Hamm, Leadville; treasurer, C. O. Withrow, Denver; executive secretary, Robert S. Palmer, Denver. J. L. Robison, Grand Junction, is the newly elected fifth vice president.

Better Core Recovery Obtained in the Iron Country With Improved Drilling Technique and Equipment

New Procedure Described for First Time at Duluth Meeting of Minnesota Section, A.I.M.E. Discussion of Stope Filling at Iron River Among the Topics. Ex-Governor Stassen Speaks

Tribute was paid to the Lake Superior mining industry's wartime achievements in iron-ore production by Minnesota's former Governor, Harold E. Stassen, in addressing the members of the Minnesota Section of the A.I.M.E. at the dinner of their one-day annual meeting in Duluth on Jan. 14. As the State's chief executive at the outset of the war, he had seen the phenomenal flow of this raw material start on its way to the furnaces. Mr. Stassen's talk dealt with the future of raw materials. On these, he said, the nation's entire economy was based. The country must re-examine its economic policies and establish one that can be fitted into a total policy for all nations. An economics of raw materials that is an economics for peace is wanted. He urged professional men to study the beginnings and development of UNO's economic council.

Elmer Pehrson, chief of U. S. Bureau of Mines Metal Economics Division, was speaker at the Section's luncheon earlier in the day, where he discussed the postwar outlook for minerals, with special attention to iron and steel.

Two papers on mining topics of exceptional interest featured the program of the meeting's two technical sessions. One dealt with newly developed procedure and equipment for getting better core recovery in exploration diamond drilling; the other with sublevel stoping in combination with delayed stope filling in a Michigan iron mine. In addition there was a lecture on atomic power, this by Dean Lind, of the University of Minnesota. Presiding was Russell H. Bennett, of Minneapolis, chairman of the Section. Dr. Lloyd M. Schofield was vice chairman and R. H. B. Jones secretary-treasurer. Abstracts of the two papers mentioned follow:

New Drilling Technique on Marquette Range

Results obtained with improved diamond drilling technique and equipment in respect to the higher percentage of core recovered, were described by Dr. Stanley A. Tyler, of the University of Wisconsin's department of geology. He said that engineers realize that a true sample is basic to a sound exploration program and this has focused attention upon ways of improving sampling, as by improving the sludge sampling or by combining sludge analysis with that of the core, because core recovery is often poor in ore zones. The way to solve the sampling problem, however, according to Dr. Tyler, is to recover the core. In addition there is need for geologic interpretation. He and his associates therefore undertook to study methods of improving core recovery, in connection with an exploratory drilling program on lands of Jones & Laughlin's Inter-State Iron Co., in the Marquette district of Michigan. Helpful advice, criticism, and ideas were contributed by R. D. Longyear, Frank Pickard, L. P. Barrett, H. S. Peterson, and R. G. Comer. There was full cooperation with E. J. Longyear Co.'s engineers under a fixed-price footage contract.

The seriousness of the sludge sample problem in the Marquette district was illustrated by Dr. Tyler by a comparison of sludge and core analyses made for 5-ft. samples in a hole from 105- to 315-ft. depth. Outstanding among the discrepancies was that for the 300- to 305-ft. sample, the sludge running 44.15 percent Fe, although there was only 11.45 percent in the diorite core, indicating serious salting. In the next 5 ft., with the casing at 305 ft. and core recovery 96 percent, the sludge ran 36 percent Fe against 11.70 in the core, despite precautions taken to insure a reliable sludge sample. On the other hand, in the ore zone from 260 to 283 ft., with 53 percent core recovery, the core ran much higher in iron than did the sludge. This illustrates that the sludge sample may be distinctly higher or lower than the core sample.

An even more serious sampling problem is presented by occurrences of sulphur as gypsum in the footwall orebodies of the eastern part of the district. The ore is very soft and greasy, and in the past very little core has been recovered from it. The bit grinds the gypsum to fine dust, which dissolves in the circulating water. Thus the sludge usually runs less than 0.4 percent sulphur, whereas the core may run as high as 3 percent.

The most direct and practical method of obtaining a true sulphur analysis where gypsum is present is to core the ore, split the core, and analyze it.

Factors in Recovery

The amount of core recovered per unit footage drilled, or percent core recovery, depends on (1) character of ground; (2) type of equipment; and (3) drilling practice. In any given case, (2) and (3) may be varied, but, once a hole has been located, (1) cannot. The average driller has been prone to attribute low recovery to the nature of the ground, without considering the other two factors.

Granted that the chief purpose of

core drilling is to recover core, the basic problem becomes that of determining the physical conditions necessary for coring.

Wedging or blocking of core in the core lifter or inner tube is the chief factor which terminates the formation of core. If drilling be continued after such a block develops, no core for the footage will be recovered and some of the core made before the blocking may be ground up. Therefore the use of equipment and drilling practice which tends to minimize the chances of blocking will increase both recovery and length of run.

The practice of the region, followed before the study described was begun, was to drill in BX size until the hole had to be cased and reduced to AX size. If ore was cut, the AX hole was reamed to BX size, the flush-joint casing set, and reaming and casing at 5-ft. intervals were carried on. Sludge was always recovered and was the chief sample. Drills were gas-driven, mechanically fed machines. AX rods were used for both AX and BX holes. Bort bits, double-tube rigid core barrels, and ordinary spring core lifters were used. Drilling practice depended largely on the driller's experience. Recovery was not particularly good. In oxidized iron formation it averaged 41.52 percent for 5,793 ft. (for example), and 72.22 percent in unoxidized iron formation for 980 ft.

The Improvements

To improve the equipment the double-tube swivel or ball-bearing core barrel, successfully used in other regions for some time, was adopted. In this the inner tube is largely freed from the rotation of the outer tube by its suspension on ball bearings, this decreasing the amount of grinding and blocking within the barrel. With the double-tube rigid barrel differential, grinding often takes place between each separate piece of ore, the softer layers being usually ground up.

The ordinary fluted core lifter, which operates against the taper of the male bit, was used within the ball-bearing barrel. Some modification appeared necessary, inasmuch as it often acted so as to block the entrance to the inner tube or would rotate with the bit, either grinding the softer portions or tearing off angular fragments from the harder phases, which would eventually cause blocking. It was apparent that it should be attached to the inner tube's lower end so as to anchor it to the core. This led to the development and use of three different lifters:

1. A modified finger spring or basket lifter, designed by Frank Pickard, which fits tightly into a retaining case and screws on to the lower end of the inner tube. A straight-wall, female bit was designed to provide clearance for the case and to bring the lifter close to the bit face. The lifter is always correctly oriented, does not rotate independently of the inner tube, and anchors the tube to the core. This has worked well in soft Marquette ores but not in harder iron formation, because the fingers do not have the frictional resistance to break off hard pieces of core.

2. A lifter, designed by Mr. Pickard, to break off very hard core. It also works well in soft ground. It operates with a straight-wall female bit and consists of a thin, 2½-deg. taper fluted spring inserted in a case attached to the inner tube's lower end, which case also tapers 2½-deg. inside so that the spring wedges against it when the rods are lifted, and thus breaks the core.

3. This lifter is a modification of the standard fluted 2½-deg. or 5-deg. taper core spring, and is made by welding on top of the standard lifter a sleeve 1 in. long having a narrow metal guide also welded on each side. It is used with the standard male bit and, with 2½-deg. taper, can be brought very close to the bit face, so that it removes the core "stick-up" which is usually left in the hole. The sleeve slips inside the inner tube, the guides occupying corresponding slots in the lower end of the tube. Upon rotation they lock the lifter to the inner tube. The tube is free to move upward away from the lifter when the rods are raised. The first lifter made lasted for 532 ft.

Condition and size of rods have a bearing on core recovery. Crooked rods cause excessive vibration, promote breaking and blocking of core and subsequent grinding. In broken ground, whipping against the sides of a hole they loosen fragments which fall or cave when the rods are withdrawn. This necessitates cementing, if excessive, but ordinarily the driller will not know just where the fragments are coming from, so that cementing is uncertain and difficult. Normally some fragments will drop after each run. Such loose material in the bottom of the hole is a factor in preventing high recovery. The fragments wedge in the bit or lifter and prevent the core from entering the barrel. The driller does not usually realize that the drill is blocked, because the fragments grind the core as fast as it forms, particularly when they are hard and the ground drilled is soft. Obviously "cave" material can be greatly reduced by insisting that only reasonably straight rods be used.

Guide Rods Help

Two or more guide rods should be used directly above the core barrel to lessen vibration at the bit. These are heavier than standard rods and tend to straighten the string by weighting the lower end. Above the guide rods standard rods should be used, commensurate in size with the hole. That is, if a BX hole is being drilled, BX rods should be used, for if AX rods are used, excessive whip is likely to develop.

The study made has shown that the drilling technique actually used has an important bearing on both core recovery and the distance that can be drilled before blocking occurs.

Blocking. The operator should be able to tell just when blocking occurs that is, the point at which wedging takes place in the inner tube or in the lifter. Ordinarily when straight rods, a ball-bearing barrel, and the bort bit are used, the drill will run smoothly while coring. In the harder types of ground, blocking is usually indicated by sudden jerks or snapping of the rods, a change in engine speed, an increase in pump pressure, or the rising up of the drill rig on the platform. (In soft ground only minor changes in engine speed and pump pressure will be noted.) Jerking and snapping are caused by core crushing and breaking, as the weight of the rods and the downward pressure of the drill are transferred to the core. Sudden increase in speed may indicate that the inner tube is pivoting on a hard piece of core which has become blocked in the tube. On the other hand, a drop in speed suggests that core is being ground, for more power is needed to grind core than to form it. Changes in speed are also directly related to soft and hard layers of rock. In each case, the operator must decide which factor is responsible.

When the Drill Rises

When the drill rises off the platform, the rods are being fed faster than the bit is cutting. The bit may be blocked, or dull, or the feed rate may simply be too fast for the bit's cutting rate.

Increase in pump pressure at the time of blocking is caused by crushed ore being forced into the water channels by the weight of the rods and the drill's downward pressure. High water-pressures may also develop with fast feeds in soft ground, due to clogging caused by insufficient water to remove the cuttings.

The operators were encouraged to continue drilling until either a recognizable block developed or the core barrel was filled. They were told, however, to stop drilling immediately and withdraw the rods upon blocking, because further drilling would only result in loss of core. Thus emphasis was placed on long runs but not at expense of core.

The E. J. Longyear Co. have perfected an automatic device which warns the operator by shutting off the circulating water when blocking occurs. This device will help in removing the personal judgment factor.

The Rate of Feed

Feed Rates. Rate of feed has an important bearing on core recovery. If it is faster than the bit can cut, the rods, even if they are straight at the start, are bent against the walls at numerous points, whipping them upon rotation, and the drill is raised off the platform. Intense rod whip may do little damage where the rock is hard, strong, and free of fractures, but if the rock is fractured, soft "cave" will develop.

Mechanical feed gears were used throughout, for they afford the most convenient way of insuring that an excessive feed rate will not be used. Results indicate that one 400 feed gear (400 revolutions of the rods per 1 in. advance of bit) is the fastest advance rate that can safely be used in iron formation in the Marquette district.

A faster feed rate, usually a 200 feed gear, may be used in soft ores. Where harder cherts underlie the ore, the 200 feed gears must be removed as soon as these are penetrated or the soft ore will cave and casing with a reduction in size of hole may be necessary.

What Speed?

Drilling Speeds. The bit should be rotated slowly during the initial 4 to 6 in of each run. This allows fragments on the bottom to be worked into the center of the bit and through the lifter. It also permits the initial solid piece of ore to enter the core lifter. High speeds at this point often lead to blocking. After the first 6 in. the speed of rotation may be increased rapidly. Some favor low speeds; others drill at 1000 r.p.m. At the higher speeds the rod string tends to straighten out and thus reduce vibration. For a given length of rods there is a critical rate at which vibration reaches a maximum. As the rod-string length is always increasing, the critical vibration point also changes and thus may coincide with any fixed rotation rate.

Circulating Water. Drill operators often say that core is washed away when high circulating water pressures are used. Tests indicate that low water pressure often causes blocking, with subsequent grinding of core. If the cuttings are not carried away as fast as formed, they accumulate at the cutting face and cause a tightness which breaks off fragments of core, which wedge in the lifter and block the core. Numerous tests were made at 250 to 300-lb. water pressure in the soft, greasy ores. There was no tendency to wash away the core, and perfect recovery was made.

If the pump stops or the water hose is disconnected, in order to add a rod, the core tends to block soon after, probably due to small particles settling around the core in the tube while the water is off. When drilling is resumed, these wedge between core and tube wall and block upward movement of the core. This can usually be remedied by adding a rod and gassing the pump before drilling is started.

A constant return flow reduces rod vibration and favors more perfect coring conditions. However, cementing or reaming and casing delays are costly, so drilling was done without return water as long as core recovery was thought satisfactory. This conformed with adopted practice of not collecting sludge, even with return water, provided core recovery was 80 percent or greater.

Chucking. When a hole is down over several hundred feet, the rods usually drop from a fraction of an inch to several inches when the chuck is loosened. The string is under tension while drilling, but when the chuck is released, the weight of the rods develops compression which bends them against the walls at numerous points. If the chuck is run back and tightened, and drilling is resumed, the rods will whip the hole and "cave" will develop. Operators often mark the rods before releasing the chuck, and, then, after the chuck is run back, raise them with cable and bail to their original position. Sometimes the operator raises them an inch or so too high, or perhaps not enough. If they are raised above their original position, the lifter will engage the core and break it off. On drilling again, the broken core wedges and a block develops.

The personal factor can be eliminated by installing a second chuck below the regular one. Drilling is continued until the lower chuck presses tightly against the casing. The drill is stopped, and the regular chuck loosened, run back, and tightened. The lower chuck is then loosened, raised, and tightened below the regular one. Thus the original position of the rods can be maintained within 1/16 in. and numerous blocks in soft or broken ground prevented.

Maintenance. Low recovery and short runs are often due to (1) crooked rods, (2) crooked outer or inner core-barrel tubes, (3) core lifter broken, bent, or of wrong dimensions, or (4) to stiffness or freezing of the bearing supporting the inner tube. Regular inspection is good insurance against these difficulties.

Results Striking

Marked improvement in core recovery in even the most fractured types of iron formation without increase in cost has been achieved with the equipment and practices described. Comparative summaries follow:

In 18 holes, totaling 5,768 ft., drilled by standard practice with the double-tube, rigid core barrel in oxidized iron formation, core recovery averaged only 41.6 percent and footage per shift 14.2. Miscellaneous costs, which included charges such as reaming and cementing not included in the fixed charge per foot, were $1.13 per foot. Average depth of hole was 320 ft. In a 1,328-ft. hole drilled in the same manner but in unoxidized iron formation, the recovery was 72.2 percent, the footage 10.9 ft. per shift, and the miscellaneous costs were $0.54.

Introduction and use of the double-tube swivel core barrel with new type core lifters attached to the inner tube resulted in an average core recovery of 70.7 percent in five holes totaling 5,919 ft., an increase of 29.1 percent over that obtained with the double-tube rigid core barrel. Footage per shift was 8.1 and miscellaneous costs were $0.98.

In the second period characterized by improvements in drilling practice, a further increase in core recovery to 86.8 percent was attained in 10 holes totaling 7,949 ft. in oxidized iron formation. Footage per shift was 12.5 and miscellaneous costs were $0.16. Here the double-tube swivel core barrel and the new No. 2 core lifter were used.

Dr. Tyler states that with other improvements which are being tried out the average core recovery may be raised to at least 95.0 percent.

Primary cost figures are not available. However, any improvement in practice which will eliminate core loss will also produce direct savings in power, labor, overhead, and diamond costs. Records on bits used definitely show higher footage per bit and an increase in length of run to substantiate this. The increase in the rate of progress means a reduction in labor cost.

One hole drilled entirely in BX size to 2,133 ft. penetrated mostly unoxidized iron formation. Core recovery averaged 98.5 percent and an average of 17.6 ft. of progress was made for each 8-hr. drilling shift. This hole was drilled by Sprague & Henwood, Inc., under terms of a modified cost-plus contract, and thus primary cost figures are available. Cost per foot is: Labor $1.80, profit factor 50c, supplies 44c, depreciation factor 40c, diamond loss 31c. Total cost per foot for entire hole was $3.45. Higher costs are to be expected in the oxidized phases of the iron formation.

Sublevel Stoping With Delayed Filling

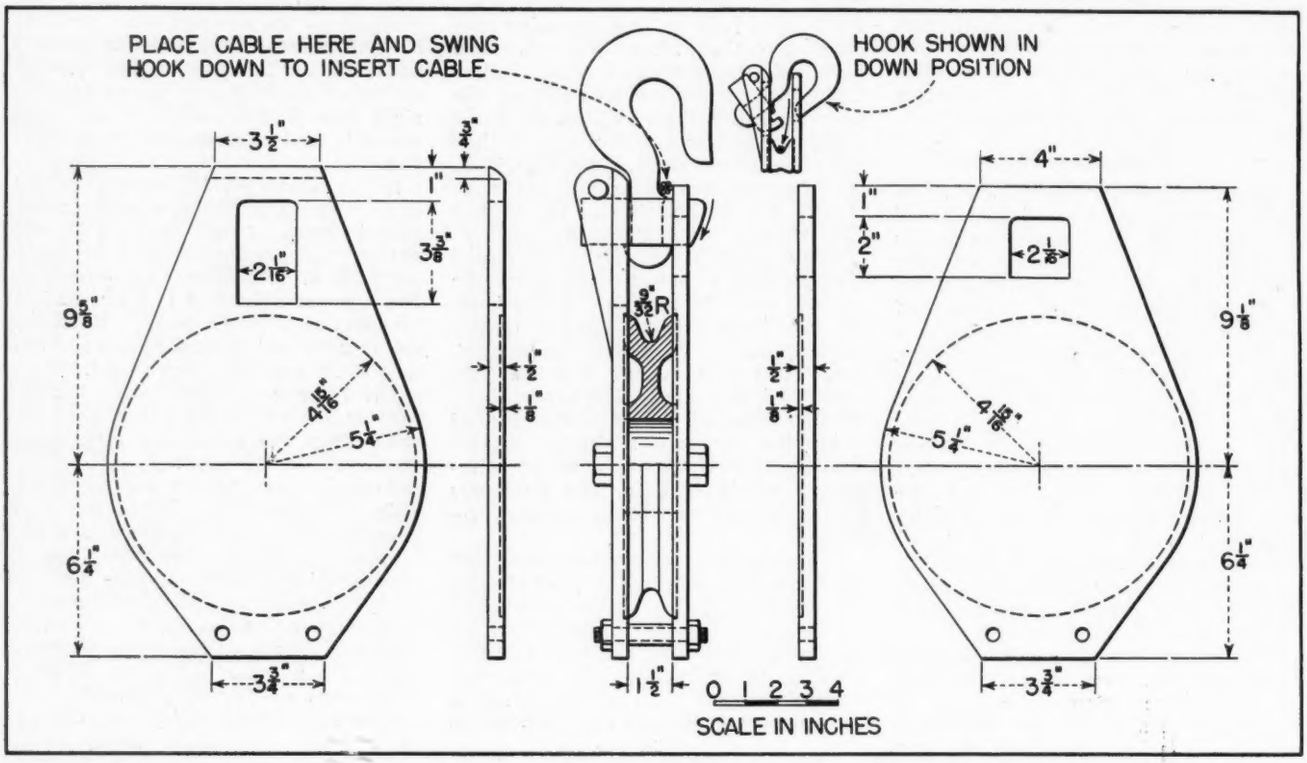
Earl E. Hunner, general manager of M. A. Hanna Co.'s iron-ore operations, read the paper on sublevel stoping in combination with delayed stope filling that is mentioned in the second paragraph of this report, in the absence of the author. The paper, prepared by G. A. Koehler, chief mining engineer under Mr. Hunner, deals with operations at the company's Hiawatha mine, at Iron River, Mich., on the Menominee Range. The Hiawatha was selected as a typical iron mine in the district using sublevel stoping followed by filling.

The Hiawatha orebody, according to Mr. Koehler, lies along the steeply dipping north limb of a syncline. Throughout this major structure there are many smaller wrinkles or folds which cause the direction and the thickness of the deposit to vary. The total length of the ore formation with the minor interruptions thus far developed is about 3,600 ft. The orebody throughout its present depth of 2,000 ft. has averaged about 40 ft. in thickness, being somewhat narrower at the upper levels and showing a marked increase in thickness on the bottom levels. This increase probably indicates that operations are nearing the bottom of the trough or that a ma-

(*Continued on Page* 164)

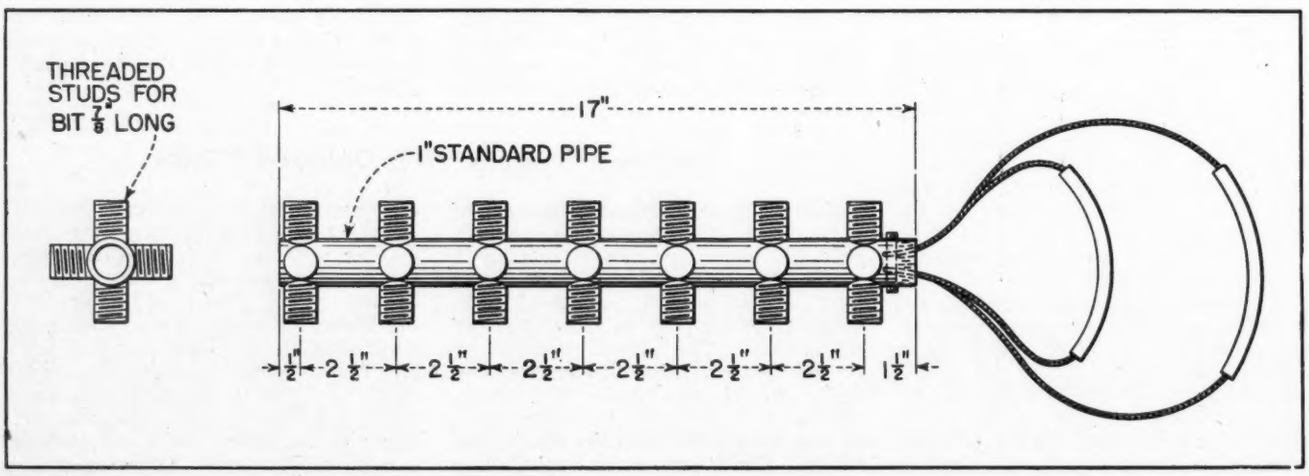
OPERATING IDEAS

Hinged Hook Admits Rope Into Scraper Pulley



A SIMPLE SWING of a hinged hook permits insertion of a scraper cable in this snatch block devised by C. V. S. Roosevelt at the Parral unit of the American Smelting & Refining Co., Chihuahua, Mexico.

Bit Carrier Is Made of One-Inch Pipe



THIS CARRIER was devised by W. J. Upton, Parral Unit of the American Smelting & Refining Co., Chihuahua, Mexico. The handle is made with ⅛-in. cable and pieces of discarded hose or ½-in. pipe. Wires of the cable are looped around the pin in the end of the pipe before being babbitted into position. Carrier holds 28 bits.

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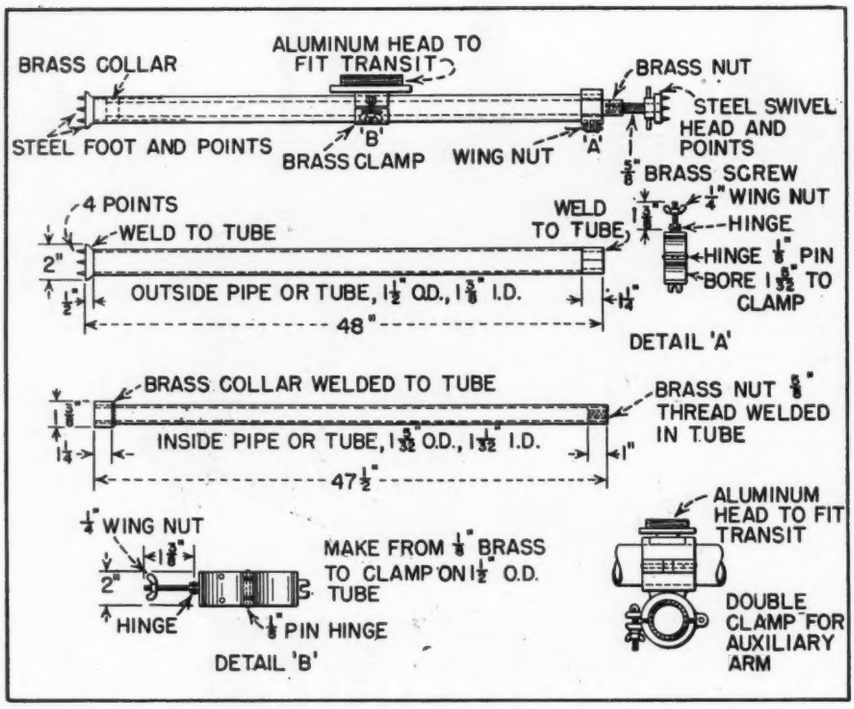
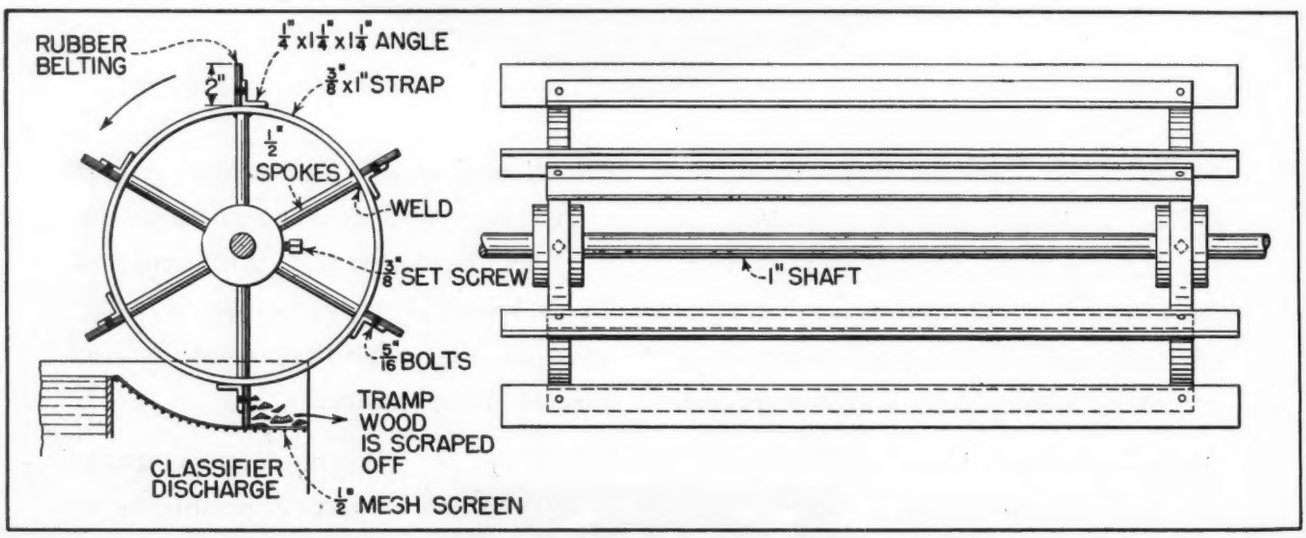
Transit Bar Simplifies Raise Surveying



This adjustable transit bar can be used to survey raises or horizontal openings where mine crews would normally interrupt work. The support was designed and built by Archie Gilles, master mechanic, Morning mine, Federal Mining & Smelting Co., Mullan, Idaho. The outer pipe is fitted with a steel footpiece and a clamp which holds the sliding inner pipe in any desired position. A brass collar on the smaller pipe guides sliding motion, and a jack-screw at one end enable the operator to lock the bar tightly in final adjusted position. The transit may then be mounted on the aluminum head, which is attached to the sliding clamp "B." A hinged wing-nut construction facilitates attachment of the sliding clamp.

An auxiliary cross-arm and double clamp permits the surveyor to spot his transit under a point which is not located directly above the transit bar, an especially desirable feature for raise surveying.

Paddle Wheel Scraper Removes Tramp Wood



Tramp wood which finds its way into mill feed is removed from the discharge end of a Dorr classifier by three paddle wheels mounted on a 1-in. shaft. Scrapers attached to the wheel revolve over a section of ½-in. screen bent on an 18-in. circle to conform to the arc swept by the scrapers. The screen covers the discharge trough of the classifier as shown in the accompanying sketch submitted by Charles Labbe, Las Vegas, Nev.

A small independent motor drives the paddle wheels at approximately 10 r.p.m. To simplify construction and maintenance, three wheels are mounted instead of one wheel. This also permits alternating the position of the scrapers to avoid interference with wave action. Paddles are constructed of scrap rubber belting and are bolted to angle irons mounted on rims of ⅜ x 1-in. strap steel. Hubs of the paddle wheels are mounted on the common shaft with ⅜-in. setscrews. Spokes of ½-in. round steel are welded as shown.

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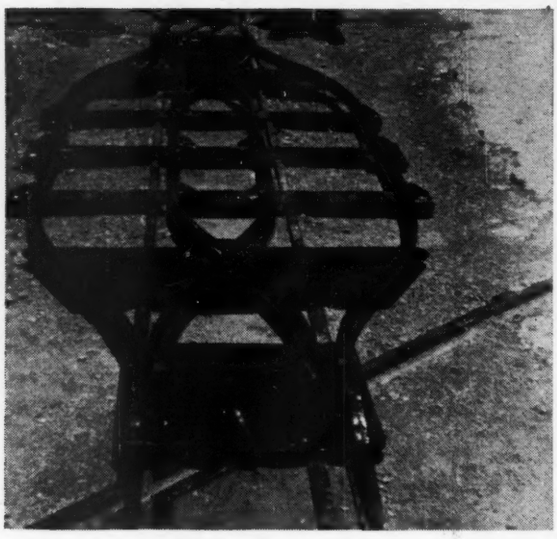
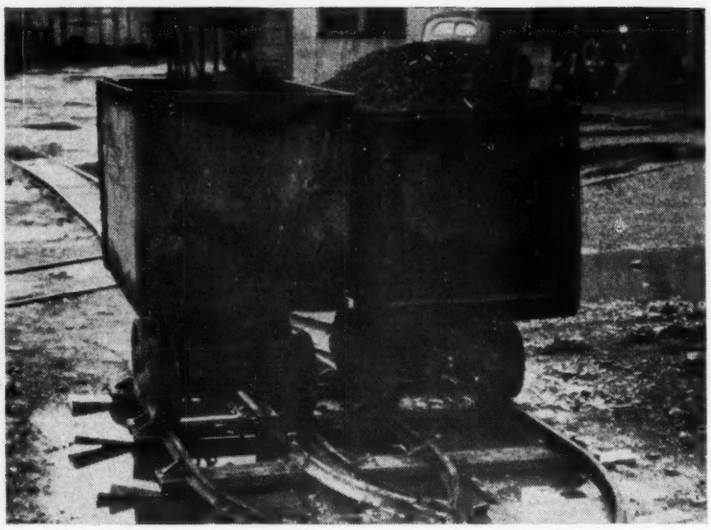
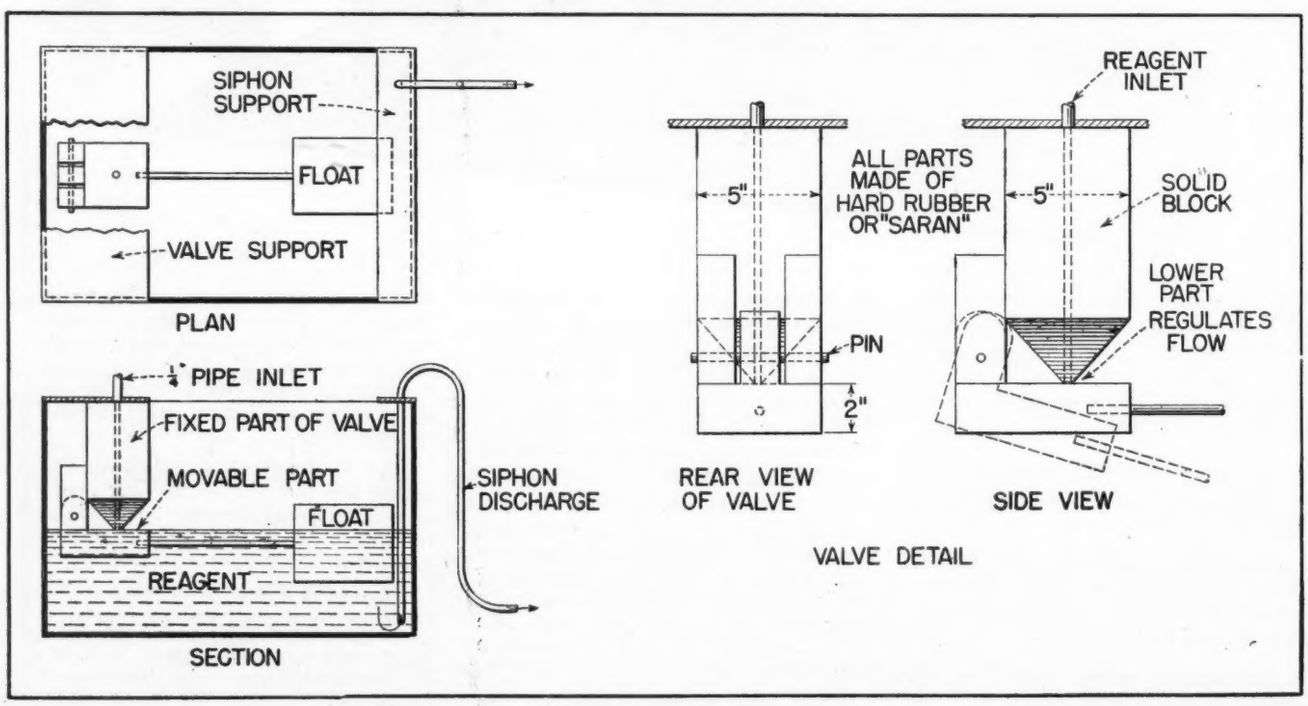
Mine Cars Are Switched on Portable Unit





THIS PORTABLE SWITCHING UNIT was built by William Toniolli, master mechanic of the El Potosi mine, Santa Eulalia, Chihuahua, Mexico. It is shown in use at the surface plant of the mine.

Feeder for Sulphuric and Hydrofluoric Acids



Acid-resistant reagent feeders are sometimes difficult to maintain. This simple design has performed satisfactorily for laboratory work, and can be used to feed hydrofluoric acid or sulphuric acid if proper materials are used in construction.

The box is made of sheet lead, chemical grade. If hydrofluoric acid is used, all other parts, including the discharge tube and valve, are constructed of "Saran" (Dow Chemical Co.). If sulphuric acid is used, all other parts should be made of hard rubber.

The fixed part of the valve is a solid block, the bottom of which tapers to a point. A 3/16-in. hole through the block admits the reagent. The lower part is actuated by a float which allows the reagent to flow into the box whenever the level drops below that shown in the drawing. Rate of flow can be regulated by adjusting the position of the siphon discharge tube which is supported by a thin strip across the top of the box.

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PERSONAL NEWS

Thomas Denton, until recently acting chief of the Tucson, Ariz., division of the U. S. Bureau of Mines, has joined the staff of the Potash Company of America. He is succeeded as acting chief of the Tucson division by **W. R. Storms.**

Victor I. Mann, formerly resident engineer for American Smelting & Refining Co., has left New York to resume the position of general manager for Big Bell Mines, Big Bell, Western Australia.

Rudolph T. Elstad has been elected vice president of Oliver Iron Mining Co. He has been associated with the company since 1917. **Warner P. Wolff** becomes chief mining engineer of the Hibbing-Chisholm district and **Robert M. Mole**, assistant chief mining engineer. **A. Y. Peterson** and **Guy E. Diehl**, vice presidents, and **Harry S. Sherman**, general superintendent of the Hibbing-Chisholm district, have retired but remain associated with the company in supervisory capacities.

A. J. Keast has been made chief general manager of mines and works of Zinc Corporation, Ltd., and New Broken Hill Consolidated, Ltd., at Broken Hill, New South Wales, Australia. **H. Middleton** has become chief engineer for the Zinc Corporation.

P. F. McIntyre has been made manager of the personnel division of Consolidated Mining & Smelting Company of Canada, Ltd. **R. R. McNaughton** has become manager of the metallurgical division. He is succeeded as chief metallurgist by **A. D. Turnbull. F. C. Ransome**, acting superintendent, has been promoted to be superintendent of refineries and **A. G. Robertson** becomes his assistant.

Kenneth DeP. Watson, geologist, has been made associate professor in the department of geology and geography at the University of British Columbia.

Richard W. Smith, formerly district engineer with the U. S. Bureau of Mines at Tuscaloosa, Ala., has been appointed assistant manager of the Natural Resources Department, Chamber of Commerce of the United States, Washington, D. C.

J. M. Romslo, mining engineer with the U. S. Bureau of Mines, has been transferred from the Rolla office of the bureau to Tucson, Ariz. Mr. Romslo was attached to the Little Rock, Ark., office for several years before coming to Rolla in November 1945.

R. Pitman Hooper has been appointed general manager of operations of New Broken Hill Consolidated Ltd., Broken Hill, New South Wales.

Harold Mortimer-Lamb, well known for his many services to Canadian mining, long a contributor to *Engineering and Mining Journal*, and dean of all its field correspondents—his first copy covering mining news having been published in 1897—relinquished his connection on Jan. 1, 1946. Mr. Lamb was born at Leatherhead, Surrey, England, on May 21, 1872, and was educated at private schools in England and Belgium. He came to Canada in 1889 and commenced his long journalistic career as editor of the *Chilliwack Progress* in 1891. In 1894 he moved to the Boundary district, where he gained his initial experience in prospecting. He became editor of the *Midway Advance*, and shortly thereafter established the

HAROLD MORTIMER-LAMB

Boundary Creek Times at Greenwood, B. C. The late Senator Bostock, publisher of the *B. C. Mining Record*, in 1897 appointed Mr. Mortimer-Lamb as editor and subsequently he became managing editor and a director of this pioneer British Columbia technical mining journal.

Mr. Mortimer-Lamb commenced his long association with *Engineering and Mining Journal* as a correspondent 49 years ago. At that time, also, he undertook special publicity work for the British Columbia Department of Mines and helped to organize the Provincial Mining Association, which body he subsequently served as secretary and director. In 1901, he became a member of the Canadian Mining Institute and was elected Institute Secretary in 1903. Also in 1903 he was appointed editor of the *Canadian Mining Review*, subsequently serving as associate editor of its successor, the *Canadian Mining Journal*. In 1908 Mr. Mortimer-Lamb was appointed secretary-treasurer of the Institute and in the following year was selected by that organization as its official representative to the Mining Congress at Dusseldorf, Germany. During the first World War he acted as chairman of the Central Directing Committee of Technical Organization, cooperating with the Advisory Council for Scientific and Industrial Research.

Because of ill-health, he resigned as secretary-treasurer of the Canadian Institute of Mining and Metallurgy in 1919, returning to British Columbia with the title of Secretary Emeritus, and in the following year he was elected secretary-treasurer of the British Columbia Division of the Institute, an office he held continuously until his resignation this year.

In 1922 Mr. Mortimer-Lamb organized the Mining Association of British Columbia, and was appointed secretary-treasurer, serving in that capacity until 1945. He accepted the editorship of the *B. C. Miner*, now *Western Miner*, when that publication first appeared in 1928, and served in that capacity until January 1946, at which time he relinquished some of the more arduous editorial duties, but continued to serve the publication as consulting editor.

R. W. Diamond, vice president and general manager of Consolidated Mining & Smelting Company of Canada, Ltd., was elected a member of the board of directors of that company at the recent annual meeting held in Montreal.

Robert Carver, previously in charge of operations at Pellaire Gold Mines, Ltd., for Quebec Gold Mining Corporation, has left for Bolivia, S. A., where he will be employed on the staff of Patiño Mines & Enterprises.

Joseph C. Rovensky has been elected chairman of the board of Patiño Mines & Enterprises Consolidated, of Bolivia. Mr. Rovensky was formerly vice president of Chase National Bank. He is also president of Patican Co., Ltd., a Patiño subsidiary, to explore for minerals in Canada.

R. D. Satterley, of Iron River, Mich., Inland Steel Co. superintendent of Sherwood iron mine, has been made assistant general superintendent of iron mines for the company.

W. F. Shinners, of Hibbing, Minn., was recently appointed by the M. A. Hanna Co., of Duluth, to be superintendent of the company's iron ore properties in the Mesabi Range.

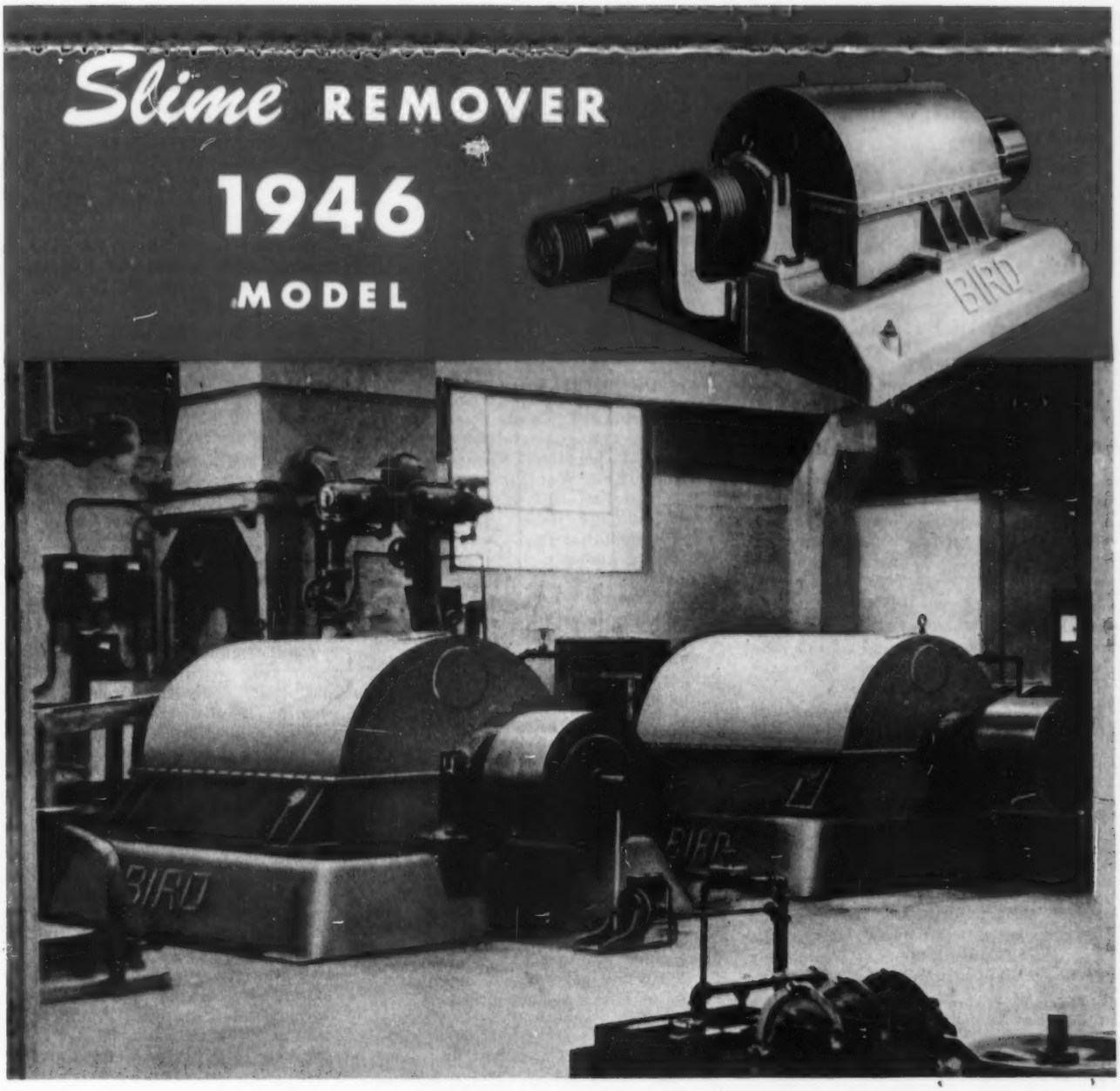
Gavin A. Dirom left by plane recently for Saudi Arabia, where he will be employed by Premier Gold Mining Co., Ltd., for the next six months.

R. H. B. Jones, of Duluth, was elected chairman of the Minnesota Section of the A.I.M.E., succeeding **Russell H. Bennett**, of Minneapolis, at the annual

Slime REMOVER

1946

MODEL



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The BIRD Centrifugal CLASSIFIER

meeting of the section in Duluth on Jan. 14. **C. R. Emerson**, of Virginia, on the Mesabi, was made vice chairman, and **W. L. Taylor**, of Hibbing, secretary-treasurer.

Dr. James Fisher, after 50 years of service at the Michigan College of Mining and Technology, retired Dec. 31, 1945, as director of extension activities. He is succeeded by **Prof. F. L. Partlo**, a native of Fairgrove, Mich., and a graduate of Saginaw high school. Though no longer officially connected with the college, Professor Fisher will have an office in the administration building. He will devote his time to two projects—the secretaryship of the M.C.M.T. National Alumni Association, and a history of the Copper Country, including the college.

E. N. Pennebaker, for some years chief geologist for the Consolidated Coppermines Corporation at Kimberly, Neb., left recently with Mrs. Pennebaker for South Africa to conduct a geological survey of properties of the O'Okiep Copper Co., Ltd.

George E. Woodward, a native Denverite, has assumed charge of the Denver office of the Metal Economics Division of the U.S.B.M. to succeed **Richard H. Mote**, who has gone to Washington to become acting chief economist of the lead and zinc production division of the Bureau.

Drew F. Holbrook, geological engineer and veteran of the Army Air Force, has recently been employed by the Arkansas Resources & Development Commission to serve as an assistant geologist with the Division of Geology. Mr. Holbrook completed forty combat missions as a dive-bomber pilot in the European theater and spent 3½ months as a German prisoner of war.

Mark C. Malamphy, project engineer for the U. S. Bureau of Mines bauxite exploration project in Arkansas during the war, has resigned from the Government agency. He will conduct geophysical exploration for a private concern in Nevada during February and March and expects to go to South Africa early in April to commence similar work.

Arnold H. Miller, consulting engineer of New York, is doing mine-examination work in Montana and Nevada.

Clifford S. Gibson, ventilation engineer for the Ontario Mining Association, Toronto, Canada, returned in January from South America. While there he outlined a silicosis-prevention program for the Peruvian mining industry and observed mine-air conditioning practices at the Morro Velho property of the St. John del Rey Mining Co. in Brazil.

O. D. Niedermeyer has been appointed general manager of the Cia. Minera de Oruro, Oruro, Bolivia. He was formerly manager of the Colquiri unit of the same company.

DR. RICHARD J. LUND

Dr. Richard J. Lund, noted mineral economist and geologist and one-time director of the Miscellaneous Minerals Division of the War Production Board, has joined the staff of Battelle Institute, Columbus, Ohio. Dr. Lund will play a leading role in the Institute's expanding studies of technical-economic problems. Prior to his three-year association with WPB, Dr. Lund served as consultant on miscellaneous minerals to the old Office of Production Management and Defense Commission, and earlier was for three years (1937-1940) editor of the *Mining Congress Journal*. In addition to his geological field work in Wisconsin, Ohio, West Virginia, Oklahoma, Texas, and the Hudson's Bay area, he is a one-time member of the faculty of the University of Wisconsin, and has held positions with the U. S. Geological Survey, the Bureau of Foreign and Domestic Commerce, and the U. S. Bureau of Mines.

James K. Richardson has been made assistant manager of the Utah Metal Mine Operators Association, Salt Lake City. He is a graduate of the Missouri School of Mines and recently completed three years' service in the Army as captain of anti-aircraft artillery. Before joining the service he was secretary of the Tri-State Zinc and Lead Ore Producers Association, and earlier was with Climax Molybdenum in Colorado.

Chandmull Rajgarhia, chief mining engineer and director of the India Mica Supplies Co., Ltd., Ghiridi, India, was a recent visitor to New York City. Mr. Rajgarhia visited some manufacturers of American mining machinery and equipment in connection with his mica mining interests in India.

R. J. Morton recently joined the staff of Oliver Iron Mining Co. in Duluth, Minn., as concentration engineer. Formerly he was metallurgical engineer with Burma Corporation, Ltd., in Burma, and metallurgist with Noranda Mines, Ltd., in Quebec.

Walter J. Macdonald was recently elected president of Manitoba Chamber of Mines; **J. D. McDonald** was made vice president; **F. J. Manning** was reappointed honorary treasurer; and **J. P. de Wet** secretary.

OBITUARIES

Homer D. Erwin, geologist, died on Sept. 10, 1945, at the age of 41. His professional work had carried him throughout the Sierra Nevadas of California and to Bolivia, Mexico, and Spanish Honduras.

George Jarvis Bancroft, Colorado mining engineer, died at Kittridge, in Bear Creek Canyon, on Dec. 23, 1945, at the age of 72.

Walter John Joseph Franks, of the British firm of Daniel C. Griffith & Co., assayers to the Bank of England and to many important mining and bullion companies in Great Britain and on the Continent, died recently in his 74th year.

Howard F. Wierum, 73, formerly chief of the Mica-Graphite Division of the War Production Board, died at his home in Canada, N. H., Dec. 31, 1945. Mr. Wierum was one of the first members of the National Defense Council and later joined the WPB. He resigned as head of the division last July.

John Roundy, 81, associated for many years with the late Jesse Knight and who did development work which resulted in many rich discoveries in the Eureka (Utah) mining area, died on Dec. 29 last at Provo, Utah.

An Appreciation of R. G. Hall

Robert George Hall, metallurgist of the Bradley Mining Co., was killed at the wheel of his car on Nov. 24, 1945. The highway collision which took Mr. Hall's life occurred on a wet evening near Hollister, Calif., as Hall was returning from a visit to the El Segundo antimony plant of the Harshaw Chemical Co. Mrs. Hall was also in the car and was seriously injured, but is recovering.

Hall was born in Hilltown, County Down, Ireland, on Feb. 6, 1871. He was the youngest of five brothers and three sisters. He entered the United States at the age of 18 and worked for a few years in Pittsburgh, accumulating funds for a college education. He was able to enroll in the Massachusetts Institute of Technology in 1893 and to study, under the direction of Dr. Robert H. Richards and others, a combination of chemistry and mining which became the basis of the metallurgical course. Upon graduation with the class of 1897 Hall went to Colorado, where he worked as a chemist with the Pueblo Smelting & Refining Co. Then followed experience in the metallurgy of gold in the San Juan and Cripple Creek fields, during that interesting period marked by the displacement of chlorination by cyaniding. Hall's responsibilities included the management of properties: that of the American Gold Mining Co. at Ouray, and others.

In 1900 Hall married Josephine Thompson in Pueblo. They have had two sons, neither of whom has followed his father's profession. From Hugh M. Hall, the younger son, I am indebted for most of the data in these paragraphs; and Hugh Hall, in turn, relied largely upon an article on his father in the *Engineering and Mining Journal-Press* of Dec. 6, 1924.

In 1905 R. G. Hall became assistant superintendent, and later general manager, of the United Zinc & Chemical Co. This firm operated in Kansas and at Leadville, Colo. Hall installed the second retort in the United States for treating high-iron zinc ores (the first had been put in by the U. S. Zinc Co., and was modeled after Belgian practice). Hall also built for United Zinc a smelter at Springfield, Ill.

From 1913 on Hall worked out of St. Louis for the American Smelting & Refining Co. For that organization he operated plants in Keokuk, Iowa, and Florence, Colo.; and he continued research on complex Western ores and the production of electrolytic zinc.

In 1918 Hall was appointed to one of the premier positions of his profession: resident manager for Burma Corporation, Ltd., of its famous Bawdin mine. Hall and his staff developed a successful metallurgical process, making lead-silver and zinc concentrates from complex low-grade ores, and smelting the former concentrate with the high-grade ore.

On Hall's return to this country in 1921 he settled in San Francisco, from where he subsequently worked under D. C. Jackling on a zinc smelter near Redding. During the middle twenties Hall departed from his profession to engage in home and apartment construction in San Francisco. Returning to the mining field in 1927 he became associated as metallurgical consultant with F. W. and P. R. Bradley, on work for their Alaska Juneau and Atolia enterprises. He continued in that capacity for the Bradley Mining Co., and in recent years specialized in laboratory and office research on tungsten, antimony, and quicksilver.

Hall had been a member of the A.I.M.E. since 1914 and delivered several technical papers before Institute meetings, including a notable paper on Gold before the regional meeting in San Francisco in 1939. In 1944 he coauthored a paper (published in "Metals Technology" of December 1945) on the Sulphur Bank and Reed Mine quicksilver plants.

R. G. Hall became intensely preoccupied with any task he undertook, and was never content with any result short of his best. In spite of this serious aspect of his nature, he always had time for geniality and thoughtfulness toward his associates. Mr. Hall's valuable work will be missed, but more than that it will be remembered that he had personality and integrity to match his learning and ability.

WORTHEN BRADLEY.

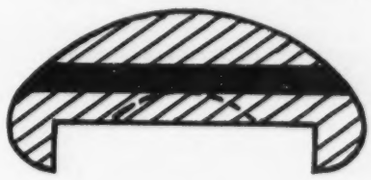
San Francisco, Dec. 28, 1945.

How Manganese Steel Castings Can Be Made Magnetic *When Conditions Require It* . . . . . .

Austenitic manganese steel has been widely accepted as a material for applications requiring the combined properties of resistance to shocks and abrasion, and non-magnetism. However, some cases are encountered where magnetism is essential, and the toughness and wear resistance of manganese steel are also required.

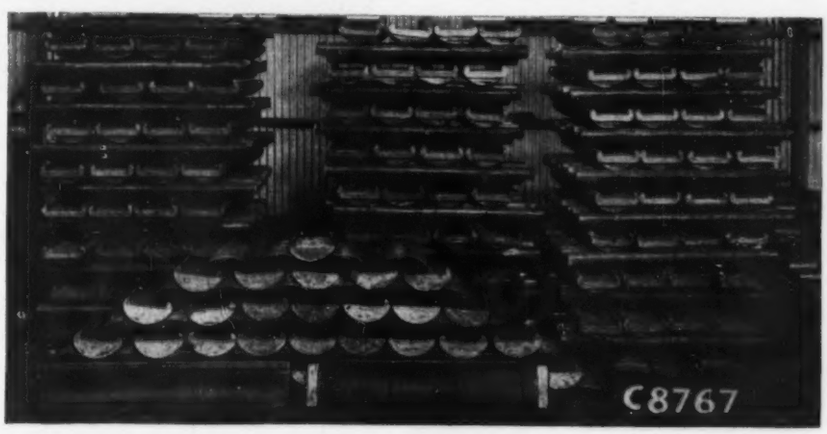
In mining and quarrying operations, it is necessary that "tramp iron" be removed from the ore, stone, clay or coal before it reaches the crusher. The tramp iron may include parts of manganese steel. An austenitic manganese steel casting will not respond to the magnetic separator. However, the non-magnetic character of manganese steel castings can be, in effect, offset by "casting in" pieces of an ordinary steel that responds to magnetism.

The 24 tons of Amsco manganese steel grizzly bar caps shown in Picture C-8767, made for a copper mining operation, have had mild steel rods cast in them as illustrated in the sketch,



giving sufficient magnetism so that if any of them become dislodged and get into the conveyor system with the ore, they will be removed by a magnetic separator before they reach a crusher to cause damage. This "conversion" of manganese steel to a magnetic part is of high value in this application, as it is the only metal which will stand up for appreciable periods in the abusive service to which grizzly bar caps are continuously subjected.

Send for Bulletin 1144-NM, "Non-Magnetic Applications of Amsco Manganese Steel."



Important part played by Amsco Power Shovel Dippers in Mining Told in Bulletin 641-D.

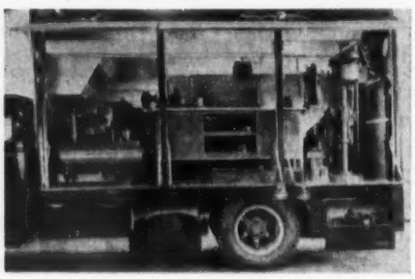
Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN Brake Shoe COMPANY

EQUIPMENT NEWS

Portable Machine Shop

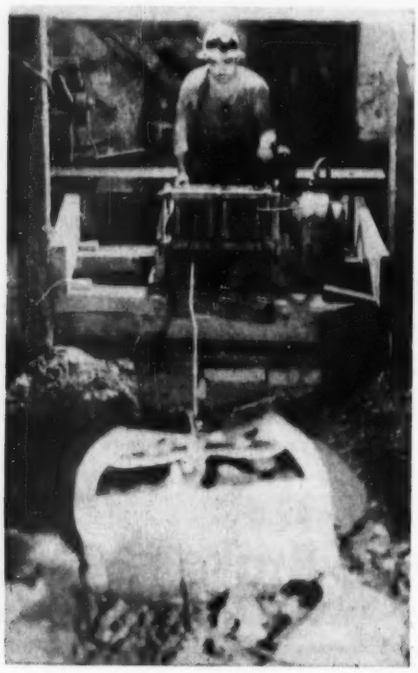
Production of a complete truck-mounted machine shop was announced recently by Davey Compressor Co., Kent, Ohio. Suitable for mounting on any standard long-wheel base truck, the shop assembly contains virtually every item of equipment needed for mechanical repair and maintenance work. The air compressor, welding generator, and power generator on the



truck are driven by a Davey power take-off, which can be inserted in the drive shaft of the truck. Separate driving engines are thereby eliminated.

Compact Slushers

Considerable reduction in over-all length has been achieved in designing the new line of 7½- and 10-hp. slushers recently announced by Sullivan Machinery Co., Michigan City, Ind. As shown in the accompanying photograph, the new slusher, called the FF Series, occupies less space than former models required. The cut in length is obtained by using a short-length a.c. "axial-air-gap" electric motor.

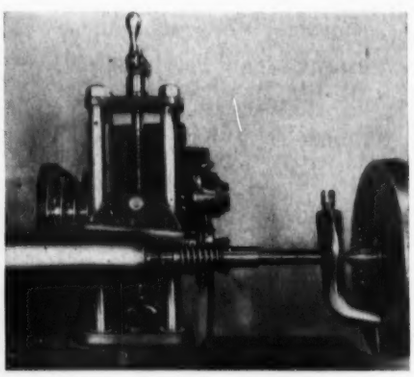


Gearing on the new slusher is stronger than on previous Sullivan slushers in these sizes, and for the first time on this size the automatic snubbing brakes of the larger models are supplied.

An interesting feature of the drive supplied is that not only can a.c., d.c., Pistonair, or Turbinair drive motors be used, but a shift from air to electric motors can be made in a few minutes at the working place.

Lathe Converter

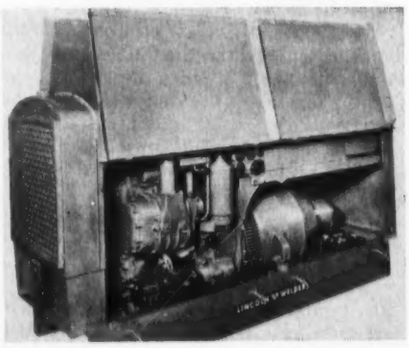
Practically a complete range of machining operations can be performed by a lathe equipped with a Master lathe converter, according to Master Manufacturing Co., 1314 East Avenue A, Hutchinson, Kan. Use of the unit adds milling, keyway cutting, angular



drilling, cutting and grinding gears, threads, worms, and screws to the ordinary functions of an engine lathe. Suitable for maintenance, repair, tool making, and experimental work, the converter comes in three sizes for bench and engine lathes from 9-in. to 36-in. swing. The photo shows the unit cutting a worm gear.

Diesel-Driven Welder

Driven by a diesel engine, a new welding machine of 300-amp. capacity is now being manufactured by Lincoln Electric Co., Cleveland, Ohio. The two-cycle engine is of simple design and is said to offer advantages in low first cost, light weight, and high efficiency. The welding equipment is similar to other Lincoln welders in providing dual continuous control of welding conditions and other features making for



smooth operation. Current range for welding duty is from 20 to 40 volts, 60 to 375 amp.

Variable-Speed Motors

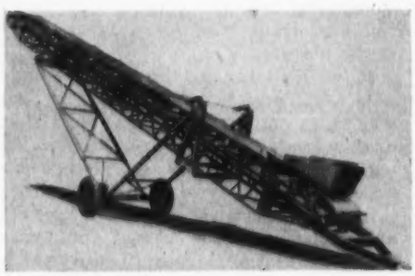
Wide speed variation is a feature of a new d.c. motor manufactured by Westinghouse Electric Corporation. Ordinary ratio of maximum to minimum speeds of a d.c. motor, obtained by adjusting the field, is about four to one. The new motor provides a range of eight to one, and the power output remains constant as the speed varies.

Bronze Pipe Fittings

A new line of non-corrosive pipe elbows for mine draniage use has been announced by Mosebach Electric & Supply Co., 1153 Arlington Ave., Pittsburgh, Pa. Made of anti-acid bronze high in lead content, the new elbows are said to be particularly resistant to acid mine waters. Castings can be made to any specifications.

Hydraulic Conveyor Truck

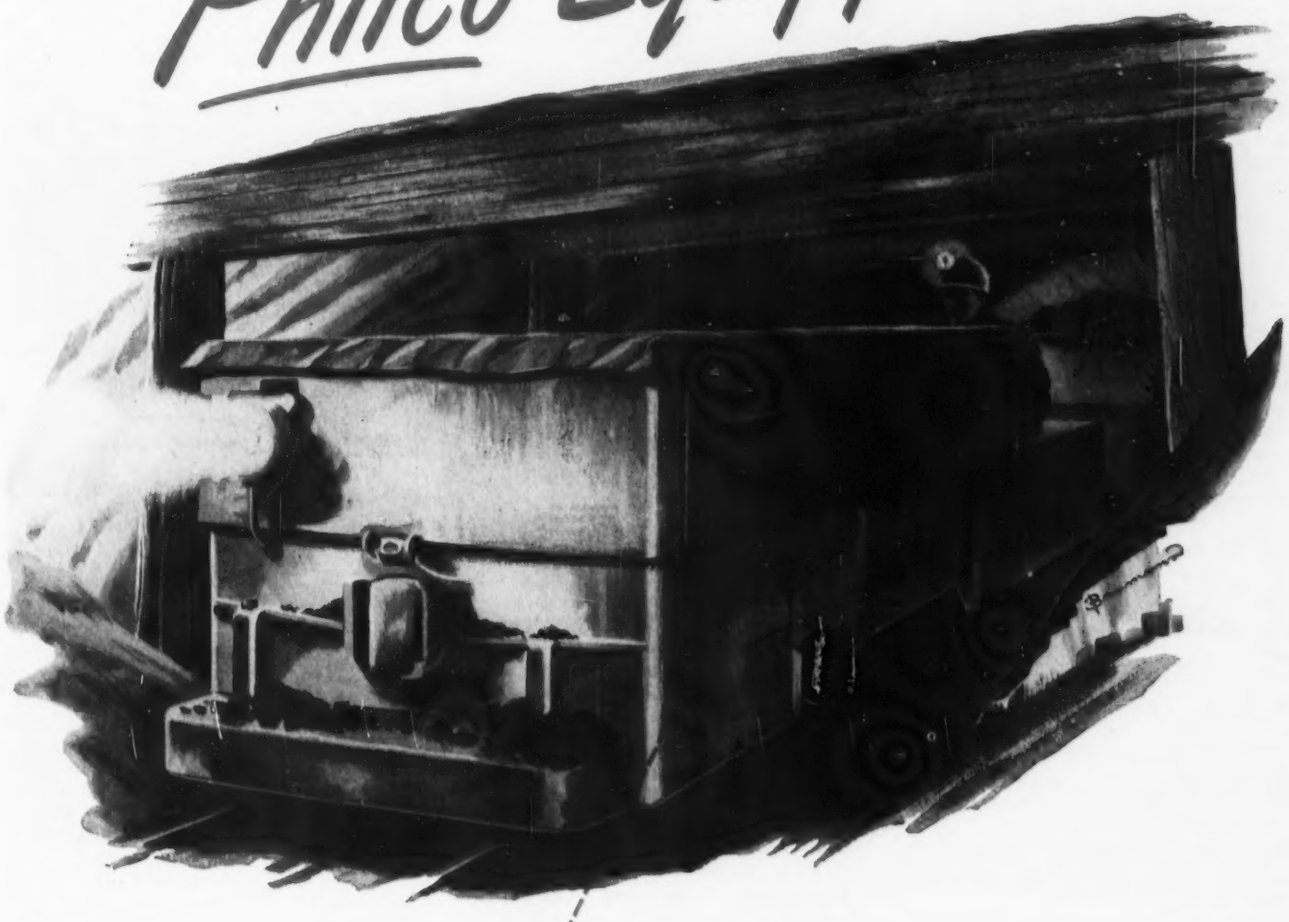
Raising or lowering of portable conveyors is said to be simplified by use of a new hydraulic cradle recently an-



nounced by Pioneer Engineering Works, Minneapolis, Minn. Action is controlled by a simple hydraulic pump.

DOWN GO COSTS WHEN THEY'RE

Philco Equipped



Many operators are getting more work at low cost from locomotives and other mine haulage equipment by changing to modern high capacity Philco Storage Batteries. This swing to Philco has gained by leaps and bounds since the introduction of the sensational new Philco "Thirty" Mine Batteries, with 30% longer life. Here is a new cost-saving development progressive mine operators are specifying for replacements and as initial equipment. Write for catalog of specification data today. PHILCO CORPORATION, Storage Battery Division, Trenton 7, New Jersey.

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FOR 50 YEARS A LEADER IN MINE
STORAGE BATTERY DEVELOPMENT

REGIONAL NEWS

MISSOURI

Iron Mountain production reported —St. Joseph Lead Co. workers present silver seal for battleship

★The Iron Mountain mine of the Ozark Ore Co., in St. Francis County, was the largest producer of iron ore in Missouri in 1945. More than 250,000 tons of hematite was shipped to the Koppers Co. blast furnaces at Granite City, Ill. The company is a subsidiary of the M. A. Hanna Co.

★The experimental mine of the Missouri School of Mines, near Rolla, is being rehabilitated. New surface construction includes a compressor house and a machine shop. The mine is to be equipped with new rail and pipe, additional cars, and a loading machine. Other equipment will include an additional 300-cu. ft. compressor and a 100-kw. diesel-electric plant.

★Prospect drilling for lead is reported in Ste. Genevieve County, northeast of Fredericktown.

★Mill construction at the Alice mine, in Ozark County, has been halted temporarily. The property, operated by G. E. Doane, is currently shipping about 75 tons of zinc ore a week to Joplin. Churn drilling by the U. S. Bureau of Mines is still under way at the property.

★The American Metals Co. is continuing its churn drilling for lead southwest of Fredericktown.

★Zinc ore from the Big Hurricane mine, near the Missouri-Arkansas border, is to be tested at the metallurgical laboratory of the Missouri School of Mines. The mine, owned and operated by the S. & G. Mining Co., is being reopened after a two-month shutdown. About 30 men are employed. The operation is directed by Tom Grimmet.

★At a ceremony at Flat River, Mo., Sunday, Jan. 6, 1946, Governor P. M. Donnelly, on behalf of the mine, mill and smelter workers of the St. Joseph Lead Co., presented a silver plaque of the Great Seal of the State of Missouri to the battleship named for their state. The 30-lb. plaque was cast from silver mined in the St. Joseph Lead Co.'s southeast Missouri lead mines. It was accepted for the battleship "Missouri" by Captain R. H. Hillenkoetter, commanding officer. Presiding at the ceremony was Clinton H. Crane, president of the St. Joseph Lead Co., who was accompanied by the following executives of the company: I. H. Cornell, vice president; Andrew Fletcher, vice president and treasurer; E. V. Peters, vice president. About 10,000 Missourians gathered at this lead center to witness the presentation. Among them were Senator Donnell and Representative Carnahan.

President Truman and James Forrestal, Secretary of the Navy, sent messages of appreciation when this 30-lb. silver plaque was presented to the battleship Missouri in behalf of workers of the St. Joseph Lead Co. at a ceremony in Flat River, Mo.

TRI-STATE

Marginal operators concerned about cut in concentrate prices—Eagle-Picher sinks new shaft

★Smelters in the Tri-State district have reduced the price of zinc concentrates $5.28 a ton—from $55.28 to an even $50. This was the first change in the base price since the week ending Oct. 12, 1941, when the ore quotation was advanced $6.70 a ton. Action of the smelters followed the discontinuance at the end of 1945 of a $5-a-ton subsidy paid for the treatment of Tri-State blende by the Office of Metals Reserve, RFC. It was reported locally that federal premium quotas for district operators would be revised to take care of the drop in the local market, except on zero "C" quotas. It also was pointed out that as the price of metal could not be increased because of the OPA ceiling of 8.25c. per pound, East St. Louis, the smelters were confronted with increased costs that could not be met without a reduction in the price of Tri-State concentrates. Some mine operators, particularly those having marginal operations, were concerned as to how they, without some actual assurance of relief, would adjust themselves to the reduced price. The reduction in price to the new base level also abolished in the open market the existing ratio of 6.70 to 1 for the zinc ore price against the Prime Western grade of slab zinc quotation per 100 lb., East St. Louis (average weekly *E.&M.J.* quotation), which was established as the basis of settlement by the Eagle-Picher Mining & Smelting Co. at its Central mill on May 11, 1940, with approval through the Quapaw Indian Agency by the U. S. Department of the Interior.

★The entire holdings and properties of the Lawyers Lead & Zinc Co. in the Picher mining field were sold to the Marcia K. Mining Co., Inc., on Dec. 29. George O. Pearson, of Joplin, veteran Tri-State mine operator for more than 50 years, who was secretary-treasurer of the Lawyers company, announced the sale. Properties sold include Indian leases on 200-acre allotment of Thomas Buffalo, on which Lawyers mill is situated; 160 acres of Buffalo Calf, and 200 acres of Frank Buffalo, the latter known as the Bull Frog lease. Lawyers company had operated five shafts on the first two tracts and did considerable churn drilling on the other one. The new operating company is continuing operations at mill shaft and most likely will reopen the north shaft shortly, and is carrying on development work underground preparatory to expansion of production in near future. The purchasing company is headed by Claude Jones, of Miami, who is vice president and general manager of the Davis-Big Chief Mining Co. Floyd L. Bumgarner, of Joplin, is vice president, and Louis J. Bowers is secretary-treasurer.

★Eagle-Picher Mining & Smelting Co. has started the sinking of a new 225-ft. shaft on the Buffalo lease, a mile northwest of Quapaw, according to S. S. Clarke, of Baxter Springs, general mine superintendent. The site of the shaft, which has been designated as the No. 2 mine, is about 1,000 ft. east of the No. 1 shaft put down on the lease a few years ago, Clarke said.

★M. & W. Mining Co. has completed a new compressor plant near the company's offices on the old Huttig lease, a mile and a half northeast of Picher. An 888-cu. ft. and a 750-cu. ft. compressor have been installed. Airlines have been extended to various mines on the Huttig, old Federal Brewster, and the 96-acre Brewster tract. The company is treating its ore at the old Barnsdall mill, on the Brewster land, a mile northeast of Baxter Springs. With the shift of ore mined at the Lula Bell Mining Co., from the Beck No. 1 mill to the Youngman mill,

WHERE INDIVIDUAL PROTECTION MEANS HIGHER INDIVIDUAL PRODUCTION.

EDISON ELECTRIC CAP LAMPS

M·S·A SKULLGARDS

Production is based ultimately upon the *man* in the mine. By his hands machines are guided, material moved, product volume maintained.

Keep him *safer* with better light to work by . . . better head protection against hazards below ground. The specifications are simple: EDISON ELECTRIC CAP LAMPS and M.S.A. SKULLGARDS; the *results* are manifest in improved figures wherever comparisons are made!

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DFC Oil Fired Assay Furnaces give uniform and thoroughly dependable results. They've been the choice of assayers thruout the world for 70 years.

Furnaces are lined with high alumina body tile and muffle supports, and with best fire clay muffles. Completely insulated with cellular siliceous material for greater heating efficiency and maximum operator comfort.

Rugged low pressure oil burner delivers dependable heat by fully atomizing any fuel above 24° B. and mixes it with just the right amount of air for correct combustion. Economical to operate, easy to control. Adjustments stay put, once they are set.

Available 1, 2, or 3 muffle units using a common fuel and air supply; total capacity 18 to 90 twenty-gram crucibles.

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The DENVER FIRE CLAY Company

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Tri-State *(continued)*

northwest of Treece, milling operations have been suspended at the Beck No. 1 mill for the time being. The Beck company is continuing operations at its No. 3 mill, southwest of Baxter Springs, treating ore from the MacArthur, Smith, and Swalley mines.

★A. J. Martin, of Joplin, has been elected to serve a second term as chairman of the Tri-State section, American Institute of Mining and Metallurgical Engineers. R. E. Calhoun, of Joplin, was named vice chairman to succeed K. R. Neal of Miami, who is moving to Texas. F. F. Netzeband, also of Joplin, was reelected as secretary-treasurer. Members of the 1946 directorate, elected recently by mail ballot of the membership, are Martin, Calhoun, and George M. Fowler, of Joplin; S. S. Clarke and H. G. Weidman, of Baxter Springs; Ernest Blessing, of Miami; Frank Cuddeback, of Commerce, and G. E. Abernathy, of Pittsburg.

ARKANSAS

Metals Reserve purchases of manganese ore cease at Batesville—Reynolds Metals Co. prepares to operate aluminum plants

★The Metals Reserve buying depot at Batesville has purchased no ore produced in the field since Jan. 1. Operators are optimistic, however, in regard to Bill 752, covering stockpile purchases, which has passed the Senate and is expected to pass the House. If the bill becomes a law, operators expect Metals Reserve to open the buying depot at Batesville again, and provide a local market for ore. Until this market is opened most of the ore produced in the field will go to Tennessee Coal, Iron & Railroad Co. in the Birmingham district and to the Woodward Iron Co., at Woodward, Ala.

★Production in the Batesville field in December totaled 1,049 tons, of which 759 tons were high-grade and 290 tons low-grade. All of the high-grade was purchased by the Metals Reserve buying depot at Batesville, Ark.

★R. P. Potasnick & Co., operating the Southern Hill, near Cushman, Ark., produced 350 tons of high-grade in December. They are carrying on pit mining operations on three levels. The plant closed down the first part of January to install a new 30-ft. Eagle log washer and a new trommel screen.

★Other production from the field for December was as follows: Charles Sims, operating the Hawkins and Grey Hill properties, 40 tons high-grade; Arkansas Manganese Co., operating the Aydelotte property, 125 tons high-grade and 225 tons low-grade; Walter H. Denison Manganese Co., producing chiefly from the Ozark property in the

Pfeiffer district, 80 tons of high-grade and 65 tons low-grade; Polk-Southard Mining Co., 164 tons high-grade.

★Lou Peterson, of Cushman, has located a deposit of high-grade ore, running 50 percent manganese and higher, on the Felts property, near Cushman. A bulldozer will be used to strip the deposit of overburden, which averages 10 ft., as soon as equipment can be acquired.

★The new mill on Mine 16, near Buffalo, operated by Lewis Flader & Associates, will be ready for operation soon. The property is developed by two 350-ft. tunnels which lead to an ore deposit which runs about 20 percent zinc. Approximately 6,000 tons of ore on the mine dump is ready to be milled as soon as the plant is completed.

★The action of Aluminum Company of America in agreeing to grant the Government free use of all its aluminum production patents has cleared the way for Reynolds Metals Co. to lease and operate two Government-owned plants in Arkansas. Alcoa had been denied the right to acquire the Government plants due to a monopoly charge against it by the Government.

★The Reynolds company will operate the Hurricane Creek alumina plant, near Bauxite, and the Jones Mill aluminum plant, near Malvern, Ark. R. S. Reynolds, Jr., vice president of the Reynolds Metals Co., has stated that his company will now be able, "to immediately step into the aluminum picture in Arkansas."

R. S. Reynolds, Sr., president of the company, has announced the key men for the plants. James Cyrus Black will be transferred from the company's plant at Listerhill, Ala., to have charge of the Jones Mill production. William W. Binford, now associated with Mr. Black, will be placed in charge of the Hurricane Creek plant, and V. G. Kneeskern will be sent from Alabama to supervise the carbon plant at Hurricane Creek. James W. Hutchinson, now stationed at Listerhill, will have general supervision over both plants. It was announced that company men would be at the plants beginning the week of Jan. 14 to receive applications for employment.

MICHIGAN

Calumet & Hecla officials report 1945 activities and appraise possibilities for 1946

★In a recent statement, E. R. Lovell, president and general manager of Calumet & Hecla Consolidated Copper Co., said:

"The demand for Lake copper is tremendous. Given a fair break on copper prices, we can expect this district to keep going for a long time. We think the long-term possibilities of the company's northern Michigan opera-

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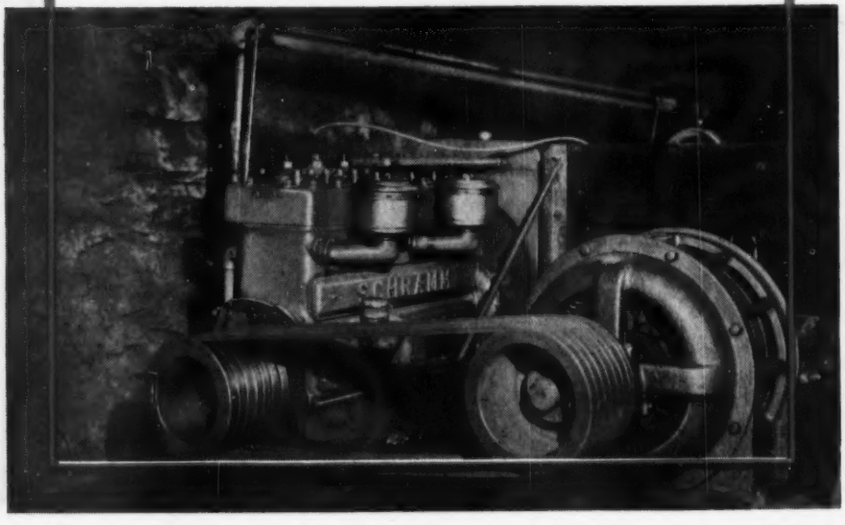

Michigan (*continued*)

tions show promise. At the Calumet division, however, we are faced with the uncertainty of Government policies relating to prices and the copper tariff.

"The Wolverine Tube division, in Detroit, in common with most other fabricators of copper and brass products, is losing money. Profitable operations can be expected only when the Government permits price adjustments that will reflect the increased cost of wages and supplies.

"Calumet & Hecla has been conserving and building up cash reserves for two main purposes: To prepare for a possible slump and possible temporary shutdown, and to be ready to capitalize on opportunities for expansion.

"We profoundly hope the slump will not materialize. We confidently expect that opportunities for expansion will appear. Within reason, everything possible will be done to perpetuate and expand the operations of the company."

Calumet & Hecla's future plans include continued exploration, the manufacture of copper chemicals, and expansion of the secondary copper program. Production would be increased materially if sufficient personnel could be obtained.

A. E. Petermann, of Calumet, attorney and a director of the company, stated that average daily employment was 2,001 in 1945 and that the company's payroll for the year amounted to $4,000,000. A total of 64 million pounds of copper was produced, of which 40 million pounds came from the seven mines of the company and the remainder from other sources, including secondary copper. Operations on the amygdaloid sands will continue for some time. The company has good prospects for the marketing of its chemical products.

According to Mr. Petermann, no real competition is expected from foreign producers if the present tariff on foreign copper is maintained. He believes that if the premium price on copper is removed on June 30, and the OPA does not establish a ceiling, copper should reach a stable price of 15c. per pound and thus enable Calumet & Hecla to operate at present levels or beyond.

The company's Central mine, in Keweenaw County, has been closed and the workers have been transferred to other branches. Central was an exploration project. No deposits of substantial value were found.

The last of the clad-steel scrap for the Metals Reserve Co. has been treated and final returns have been made. Calumet & Hecla's ammonia leaching process was the only method that could be used to separate the copper and the steel. Approximately 60,000 tons of scrap were treated during the war, which returned 21,000,000 lb. of copper to the Metals Reserve Co. and 45,000 tons of scrap to the steel plants. The copper salvaged was in excess of the settlement with the original suppliers of the material.

The contract was an excellent one for Calumet & Hecla because it furnished employment to a large number of men during its two years' life and called for the payment of a fixed profit per ton over cost of treatment. In treating this material, the company's railroad crew handled a total of 4,800 cars.

IRON COUNTRY

Minnesota labor law affects strike plans—Blueberry mine opens main haulage drift

★The strike in Minnesota's iron mines has been postponed indefinitely. A representative of the United Steelworker office in Hibbing said his office was still awaiting details with regard to the period of postponement and the reasons for deferment of the walkout. A well-informed source not connected with the union stated that the strike was postponed until Feb. 7. This indicated that the 30-day waiting period required under Minnesota law had been invoked. The law, which was passed during the first term of Governor Harold E. Stassen, who sponsored it, sets up a list of unfair labor practices, established the now-famous "cooling-off" period, and created the office of State Labor Conciliator. The heart of the law is a section requiring a written notice of intention to strike or declare a lockout. Notice must be sent to the State Labor Conciliator, and to the employer or union involved, ten days before the strike or lockout is to become effective. This has become known as the "cooling-off" period.

★The Oliver Iron Mining Co. shipped 34,435,800 tons of ore from the Lake Superior district during 1945. This compares with 37,606,282 tons shipped in 1944. From the Mesabi Range, from the so-called Hibbing district, 24,508,576 tons was shipped, from the Virginia district 9,710,580 tons, from the Canisteo district 1,623,308 tons, and from the Vermilion Range 913,036 tons.

★Jan. 1 marked retirement since V-J day of 178 employees of the Oliver Iron Mining Co. who have reached or worked beyond the normal retirement age of 63, the company announced. The list includes top officials and veteran employees, some of whom had spent up to 50 years with the United States Steel subsidiary.

★At Davison mines, Iron River, Mich., operated by the Pittsburg Coke & Chemical Co., ore production has nearly ceased because of sinking of the shaft at No. 1 property from the 650 to the 750 level. Work started Jan. 7. No. 3 shaft hoists a small quantity of ore but cannot replace production through No. 1 while sinking progresses. About 50 men will be off the payroll while sinking is completed. Rudolph Erickson is general superintendent.

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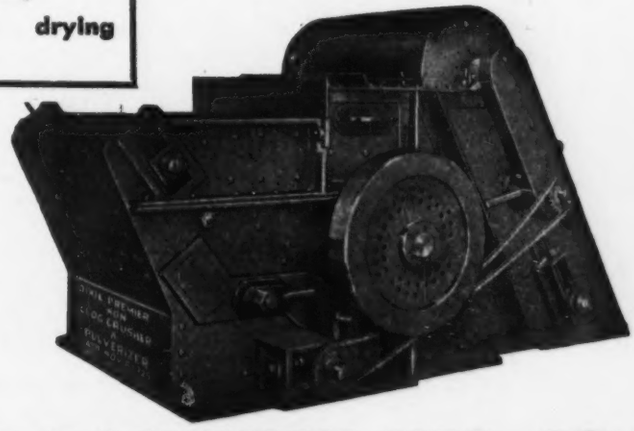

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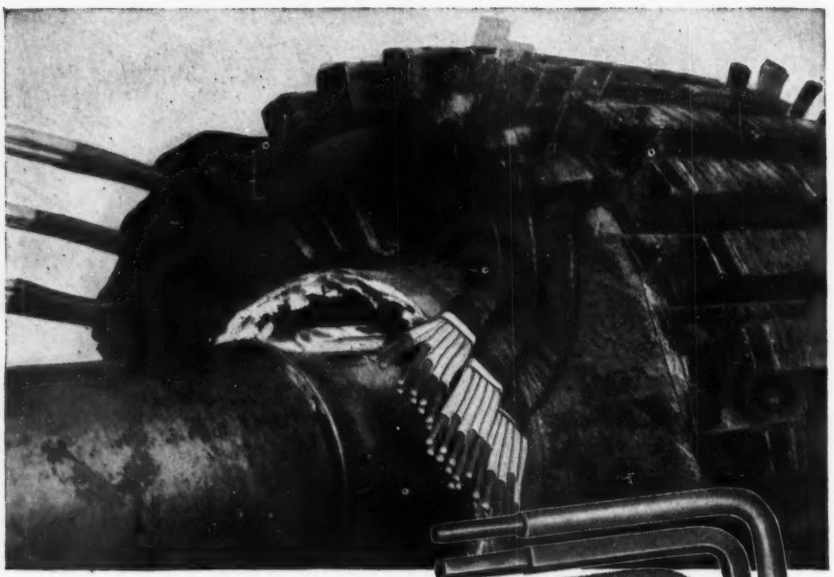

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GENERAL ELECTRIC

Iron Country *(continued)*

★The recent sale for $6,787.50 of machinery and equipment of the Ely gold mine, 6 miles west of Ishpeming, Mich., to J. J. Gray, Toronto, Canada, completes this operation, carried on by the Michigan Gold Mining Co. prior to 1937. Equipment sold included a hoist, a compressor and gold-mining machinery in both mill and shafthouse.

★At Ishpeming, Mich., mine operators have supported a community project covering the development of a playground to be completed during 1946. W. G. Mather, chairman of the board, Cleveland-Cliffs Iron Co., started the fund with a personal contribution of $30,000. Jones & Laughlin Steel Co. has given $1,000.

★At the Blueberry mine, 7 miles west of Ishpeming, Mich., the main haulage drift on the 1,600 level is being opened up. This mine was operated by the Ford Motor Co., and first shipments were made in 1929. Later it was taken over by the North Range Mining Co. and has been a steady producer because of the manganese content of the ore. R. S. Archibald is manager.

ARIZONA

A.I.M.E. section elects officers—Louis Cates discusses outlook for copper industry

★C. R. Kuzell, assistant general manager of Phelps Dodge Corporation, was named president of the Arizona Section of the A.I.M.E. at a recent meeting held in Tucson and attended by 150 members and guests. Robert W. Hughes, general manager of the Miami Copper Co., presided, and Harvey Mudd, national president of A.I.M.E., delivered the principal address, an account of copper mining on the Island of Cyprus. Among those present were Louis Cates, president of Phelps Dodge; T. H. O'Brien, vice president of Inspiration Consolidated Copper Co.; H. S. Lavender, general manager of Phelps Dodge; R. W. Thomas, general manager of Kennecott Copper Corporation; W. P. Goss, general manager of the Magma Copper Co., and Albert Mendelsohn, president and general manager of Cananea Consolidated Copper Co.

★During a recent periodic inspection of Phelps Dodge's properties in Arizona, Louis S. Cates, president, commented that Arizona's copper industry could look forward to at least three to four years of capacity production. Although 2,000 men are needed in Arizona's mines, Mr. Cates stated that the deficiency was not confined to that state alone. "The mines in the Western area, Utah, New Mexico, Colorado, and Arizona, are short about 6,000 men," he said. Unless more ore is found at the United Verde, Jerome, Mr. Cates said further, the property will be mined out

in two to three years, or at most four to five. He denied, however, that the company is negotiating to sell the property as recent rumors have stated.

Electrification of the New Cornelia pit at Ajo will ultimately cost about $2,000,000. This is the only major improvement planned at present, Mr. Cates stated, adding that Phelps Dodge had spent many millions on Arizona development in the past, including $30,000,000 to put the Morenci pit into operation. The company will continue to spend about $1,000,000 a year to keep its properties in going condition.

COLORADO

Fryer Hill operations reopened at Leadville—Strikes at smelter delay reopening of Ore & Chemical Co. plant near Leadville

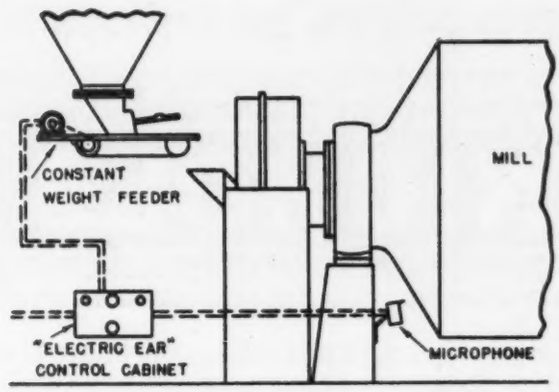
★Cripple Creek mines produced 129,000 tons of ore, valued at $1,100,000 in round figures, during 1945, the district's smallest year for many years. A. H. Bebee, vice president and general manager of the Golden Cycle enterprises, said that the obstacle to increased production is still lack of manpower. Men returning from the armed services and elsewhere have not gone back into mining sufficiently to permit full operation.

Most productive mines in the district last year were those of United Gold Mines Co., which shipped 82,828 tons, or about two-thirds the district's tonnage, and accounted for $555,000 in values, or about half the year's value. United ore came from the Portland, Vindicator (which reopened Dec. 27 after a two-months' shutdown for installation of a new shaft hoist and other improvements), from the Patti Rosa, and from various mines and dumps. The Portland had the largest production, and its ore averaged $27.10 a ton.

The Vindicator, which is operated entirely by lessee companies, is managed by Adin Marshall and P. B. Van Dolah. A company formed by Walter Harris, Walter White, and James White has begun a leasing operation on the Florietta, which is connected to the Vindicator.

Golden Cycle Corporation production was 28,946 tons of ore with a gross value of $371,547 in 1945. Principal production was from the Ajax, and from the Anchoria Leland.

★At Leadville the new year was marked by the reopening of the Ibex-Sunday-Garbutt operations, managed by Sergei Zelinkoff for American Smelting & Refining Co. The mine is on Fryer Hill east of Leadville, and has been closed for ten years. The shaft has been retimbered and a new hoist built. Development work, including diamond drilling, is planned. Last man to operate the Garbutt before this reopening was Mayor John Cortellini



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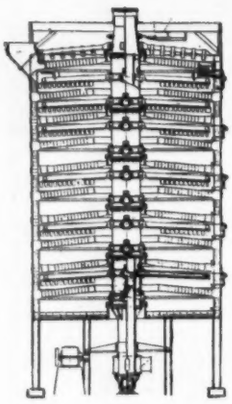

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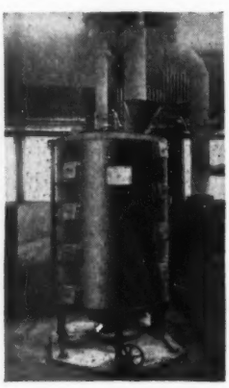

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Colorado (*continued*)

of Leadville. Another A.S.&R. improvement is the construction of a spur track into the California Gulch mill, which was bought by A.S.&R. in July. Heretofore ores brought to the mill, which is operated as a custom unit, have had to be brought in by truck. George Deshler is superintendent. The Arkansas Valley smelter operated at capacity in 1945, and 265 men were employed.

★Ore & Chemical Co.'s heavy-media separation plant west of Leadville was planning to reopen as this was written. Kurt Spohr, manager, emphasized that shutting down the plant early in December was not because of local conditions but was caused by strikes at the smelter supplied by the plant. He estimated that it treated 250,000 tons of ore in 1945, producing 50,000 tons of concentrates. The ores came from the R.A.M., Tucson, North Moyer, Robert Emmett, and Mab dumps and from the Colorado No. 2, on which the plant was working when operations were suspended.

★Lack of manpower continues to handicap Leadville operations, as in Cripple Creek, and it was noted in both centers that returning service men are not going back into the mines. In one check at Leadville of the disposition of 20 referral cards given out by USES, it was noted that only nine were returned from mines, although the 20 men were all former miners.

★At Silverton the same complaint, lack of manpower, clouded otherwise brightening prospects for 1946. Shenandoah-Dives, Silverton's largest producer, milled 152,000 tons of ore during the year, completed the 1,200 level to surface, and completed 1,000 ft. of a new long drift. Total shifts were off 10 percent from 1944, but total payroll was off only a little less than 3 percent, and this was reflected in production, which was almost exactly the same as in 1944.

★Leadville operators will continue plugging and hoping for the deep-drainage tunnel despite their disappointment when Senate and House conferees on the Interior Department deficiency appropriation bill failed to include $485,000 needed to reopen work on the tunnel and complete it to the nearest shafts. The next chance for an appropriation is in the regular Interior Department bill for the year beginning July.

★Treasury Tunnel operations continue to expand as fast as men can be found. The company now employs more than 150 men. At the Great Divide, principal development project is the driving of the Habita tunnel, together with investigation of several areas within the tunnel where mineralization is indicated. Henry P. Ehrlinger is superintendent. At the Highland Mary, production increased in 1945. At the Pride of the West, a total of 27,490 tons of ore was mined and milled in 1945.

★Gilsonite operations near Craig are expected to be expanded under new ownership of the deposits by the American Gilsonite Co., which has been formed with an equal ownership between Standard Oil of California and Barber Asphalt Corporation, which owned the mines. These latter comprise the major part of the known resources in the Utah Colorado area. Clarence F. Hansen, formerly chief engineer of Standard's manufacturing department, is president of American Gilsonite. The product, a shiny, hard, black hydrocarbon used in storage-battery cases, foundry forms, inks, and varnishes and plastics, is found in vertical veins usually open to the surface, and is mined from such veins. It is trucked to Craig, the nearest railroad point.

★Denver office of RFC recently announced that the purchase price of the Urad mine, at Empire, developed during the war for the government by Molybdenum Corporation of America and sold to that company by RFC, was exactly what the Government spent in the development—$351,503. This is one of the few instances of 100 percent recovery by the Government of the cost of a war plant.

★An embarrassing little pair of commas, which stepped in in place of decimal points, made it appear in the December issue of this magazine as though Colorado gold production had increased right out of this world. Instead of 27,705,594 oz. of gold received by the Denver mint in October, 1945, as stated, the figures should have been 27,705.594; and 15,271.434 oz. in October 1944, rather than 15,271,434.

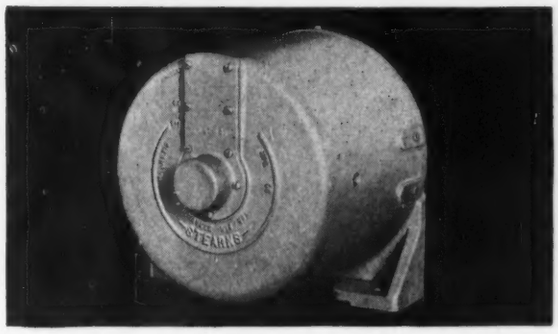
★Colorado's occupational disease compensation act went into operation on Jan. 1. Its acceptance is optional with mine owners and other employers. However, only a few firms had exempted themselves within the first few weeks of the act's operation.

UTAH

The State's operators' association elects officers—Kalunite, Inc., prepares to shut down plant

★Four advancements of Utah Copper Co. employees to key positions within the organization were announced Jan. 9. C. G. Quigley, former assistant superintendent of the Arthur mill, is advanced to superintendent, succeeding Roy Hatch, who is advanced to director of labor relations. Louis Buchman, who has been general superintendent of mines, is advanced to general superintendent of operations. Harvey L. Garrity, mine superintendent, has been made general trade foreman.

★Standard Oil Company of California and Barber Asphalt Corporation have formed a new company—American Gil-



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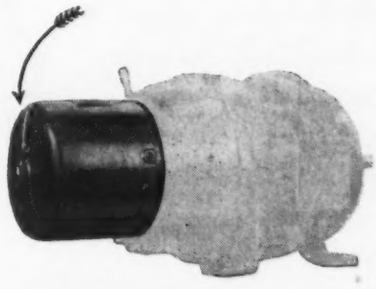

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E-FM-8

Utah *(continued)*

sonite Co.—to develop intensively gilsonite deposits of eastern Utah and western Colorado, company officials announced Jan. 2. The new concern is owned equally by Standard and Barber. Clarence F. Hanson, formerly chief engineer in Standard's manufacturing department, will be president of the new firm. Gilsonite, a solid hydrocarbon, is used extensively in manufacture of battery cases, paints, varnishes, and inks. It occurs in virtually pure state in vertical fractures. The veins vary up to 18 ft. wide, and more than 1,000 ft. deep, and several miles long. The product is trucked to Craig, Colo., nearest railroad point.

★E. H. Snyder, president and general manager of Combined Metals Reduction Co., was elected president of Utah Metal Mine Operators' Association on Jan. 3, succeeding Frank A. Wardlaw, Jr., A. G. Mackenzie, manager, announced. James W. Wade, president and general manager, Tintic Standard Mining Co., is the new first vice president; O. N. Friendly, vice president and general manager, Park Utah Consolidated Mines Co., is second vice president, and James Ivers, vice president and general manager, Silver King Coalition Mines Co., is third vice president. Mr. Mackenzie was reelected manager. Directors are: T. P. Billings, U. S. Smelting, Refining & Mining Co.; W. H. H. Cranmer, New Park Mining Co.; Kuno Doerr, Jr., American Smelting & Refining Co.; Cecil Fitch, Chief Consolidated Mining Co.; Mr. Friendly; M. G. Heitzman, Silver King Coalition Mines Co.; Otto Herres, Combined Metals Reduction Co.; Paul H. Hunt, Park Utah Consolidated Mines Co.; James Ivers, Silver King; Sherman W. Johnson, Combined Metals; Thomas F. Kearns, Silver King; Percy H. Kittle, Ohio Copper Co. of Utah; A. C. Moore, Columbia Steel Co.; D. D. Moffat, Utah Copper Co.; F. S. Mulock, U.S.S.R. & M. Co.; W. J. O'Connor, A.S. & R.; W. C. Page, U.S.S.R. & M.; M. D. Paine, Tintic Standard; H. E. Raddatz, Tintic Standard; J. D. Shilling, Utah Copper; Mr. Snyder, Mr. Wade, Mr. Wardlaw, and A. D. Young, I.S. & R.

★Following notification from Reconstruction Finance Corporation to shut down the Salt Lake alunite plant, operated by Kalunite, Inc., S. J. Burris, Jr., general superintendent, was engaged Jan. 10 to prepare the plant for shutdown condition.

★Utah section, American Institute of Mining & Metallurgical Engineers, has elected Ernest Klepetko chairman for 1946. Mr. Klepetko succeeds Burt B. Brewster. W. H. H. Cranmer was elected vice chairman and James A. Marsh was reelected secretary.

★Employment in Utah metal mines declined from 8,000 in 1945 to 6,000 in November, says a report released by the Department of Employment Security.

CALIFORNIA

Gold property in Mono County to start pilot mill — Labor shortage curbs tungsten operations

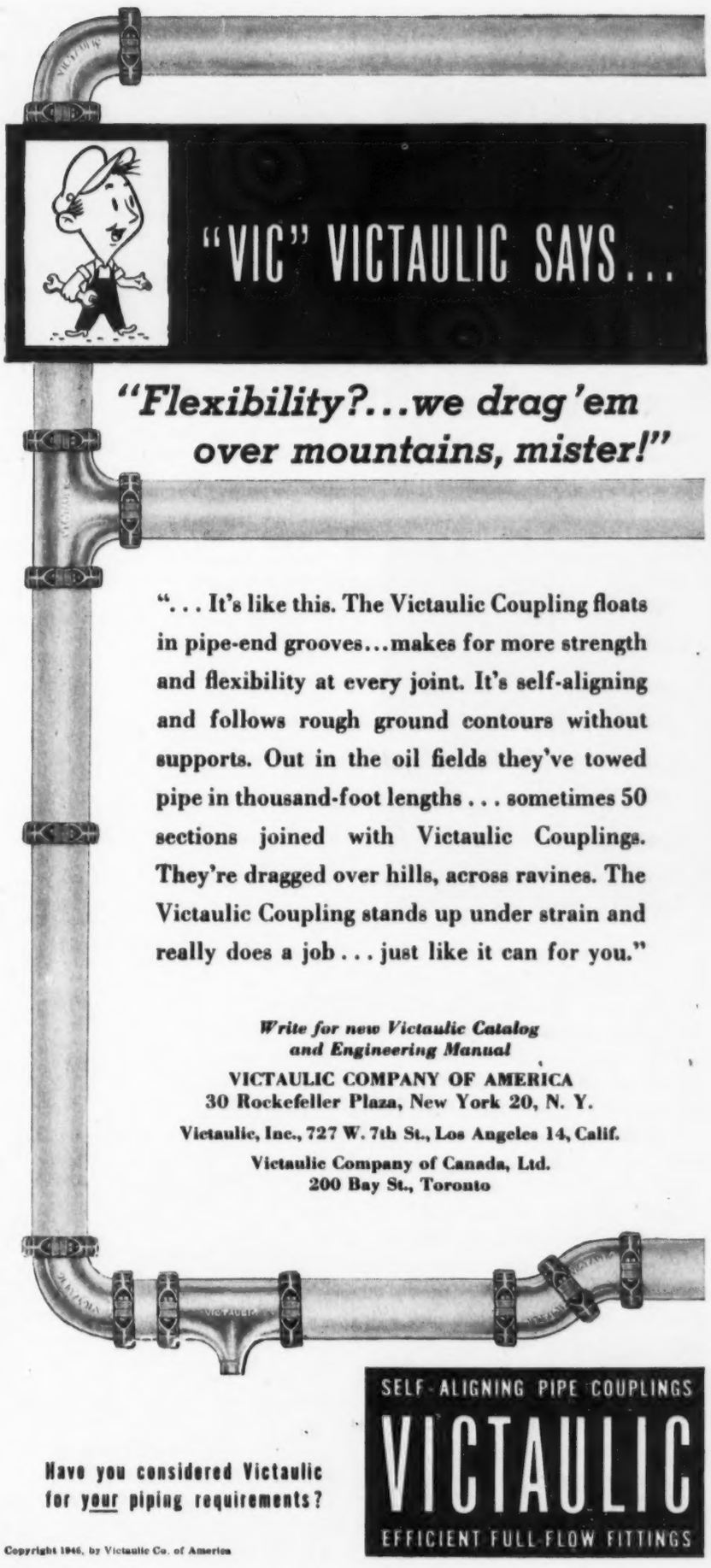
★Test work and operation of a 500-ton pilot mill are scheduled to be started soon at Bodie, famous gold-mining camp in Mono County, by Sierra Mines, Inc., a newly formed mining organization, according to W. A. Linfesty, consultant for the new corporation and superintendent of Tungstar Corporation at Bishop. The mineral holdings to be investigated are those owned by the Cain Estate and formerly operated under lease from J. S. Cain, of Bodie, by Roseklip Mines Co., of San Francisco, headed by H. W. Klipstein. Treadwell-Yukon Company, Ltd., operated the property in 1929, some years prior to acquisition by Roseklip Mines. Preliminary work under way includes installation of a power line by the California Electric Power Co., and conditioning the available mill for pilot operations. S. B. McCluskey, well-known metallurgist, will be in charge of the work.

★Black Jack Gold Mining Co. has started mining operations at its Black Jack and Ida Della gold holdings at Eagle Creek, near Sonora, Tuolumne County, where a surface plant was completed recently. The company is controlled by A. Rosselli and J. C. P. Skottowe.

★Natomas Co., Thomas McCormack, president, for the nine months ended Sept. 30, 1945, made a net profit of $71,900 before income taxes, equal to 8c a share. The company operates seven dredges in California, and recently has started up additional units to the two operated under a WPB permit during the war. In addition, Natomas owns a sizable interest in Manhattan Gold Dredging Co., active at Manhattan, Nev., and has recently installed a large dragline dredge on the Greenan Placers near Battle Mountain, Nev.

★C. E. Stewart, of Stockton, has recently acquired the Riverside gold mine, near Columbia, Tuolumne County, and expects to start mining as soon as weather conditions permit. The mine is developed by three tunnels, and equipment available includes a crusher, a stamp mill, and an air compressor.

★Mining operations, save for the long tunnel driven under contract, have been suspended at the tungsten property of U. S. Vanadium Corporation near Bishop, Inyo County, because of manpower shortage. The mill will continue to handle concentrates from the company's Nevada operation and custom concentrates from Arizona, California, and Idaho. Another well-known tungsten producer in the Bishop area, the Tungstar Corporation, has shut down the mine and plant, with a small crew being retained for maintenance and development work.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NEVADA

Chromite discovered in Candelaria district—Open-cut operations contemplated for gold property

★Standard Cyaniding Co., H. L. Hazen president-manager, has awarded a contract for surface stripping and delivery of open-cut ore to its 700-ton cyanide mill to A. J. Kirman, lately engaged in a similar project at Mercur, Utah. Mill units released to strategic metal mines during the war, including crushers, pumps, classifier, Weightometer, and belts, are being replaced under contract by Western-Knapp Engineering Co., which built the plant. The mine is in the foothills of the Humboldt range in central Pershing County, and an office is maintained at Lovelock by President Hazen and Henry Bradley, consulting engineer.

★Chromite has been discovered in the Candelaria district in southern Mineral County. Reports of the discovery met with skepticism on the part of Jay A. Carpenter, director of the State Bureau of Mines, to whom samples were sent in December, as earlier reports of the presence of chromite had not been substantiated and because serpentine, with which the metal is associated, is exceedingly rare in Nevada. A check of geological reports, however, showed serpentine to be one of the rocks of the Candelaria district and tests of the samples established the presence of high-grade chromite. Director Carpenter and staff engineers are making a study of the deposit.

★Hoist equipment and mine timbers were being assembled by the New Verde Mining Co., wholly-owned subsidiary of the Newmont Mining Corporation, in preparation for sinking a development shaft in a flat area two miles north of Goldfield, where drilling was conducted last year. The drill unit, capable of reaching only 400 ft. depth, was returned to a California property and a 700-ft. drill was scheduled to arrive shortly, with which it was the announced purpose to drill at a point a mile south of Goldfield, where some years ago a huge boulder of high-grade gold ore was found, resting on a deposit of detritus or Siebert lake-bed material of undetermined depth. A 60-ft. shaft at this point failed to reach bedrock.

★At the Getchell mine, in the Potosi district, Humboldt County, the 1,000-ton cyanide mill remains idle because of the shortage of labor, but will resume when men are available. The company is sinking a three-compartment vertical shaft at a point 3,000 ft. north of the main tunnel and open-cut workings, east of and below the massive outcrop of the orebody. The tungsten concentrator, housed in the cyanide mill structure and with rated capacity of 400 tons, is treating around 600 tons per day of scheelite from the nearby Metals Reserve stockpile, and the Getchell Mine, Inc., scheelite deposits, south of the gold mine in Granite Creek Canyon, are soon to be drilled.

★The Nevada Belmont lead-silver mine, at Hamilton, White Pine County, opened and equipped with 100-ton flotation mill around 1926 by the Tonopah Belmont Development Co., is reported to have been purchased from Eastern owners by the Utah-Nevada Tungsten Co., with offices at Salt Lake City, and Charles A. Howe of Mesquite, Nev., president. The mill, a 9,200-ft. aerial tramway from the main tunnel, mine equipment, and well-appointed camps at the mine and mill were reported in excellent condition. Because of deep snow at the 9,000-ft. altitude, the Utah-Nevada company, which has tungsten properties in southern Nevada and Arizona, will not undertake active work until spring.

★Purchase of the Diamondfield-Daisy mine, at Goldfield, one of the early producers of high-grade ore on the Diamondfield Ridge, from A. J. Seligman and associates, of New York, has been completed by Mark Bradshaw, mining engineer of Tonopah, and head of the Bradshaw Syndicate, Inc., which prior to L-208 operated a 1,200-ton cyanide plant on tailing from the dismantled 1,000-ton Goldfield Consolidated Mines Co. cyanide mill. On the Daisy property, mine reports state, there are 10 shafts, none over 200 ft. deep and all of which exposed pay ore with net of around $300,000 from smelter shipments during the latest operation ending in 1908. Engineer Bradshaw, who controls abundant nearby water supply sources, plans early development at depth and construction of a cyanide mill with provision for treating custom ore.

★Labor shortage at the property of the Copper Canyon Mining Co. in Lander County has been relieved to an extent enabling operation of the 350-ton flotation mill on two shifts during December, with prospects of early capacity production, Robert H. Raring, managing engineer, reported lately. December production was 5,590 dry tons of gold-copper ore, roughly 225 tons per day, and full-time mill operation by Feb. 1 was predicted. During 1945, when operated by International Smelting & Refining Co., under lease relinquished Nov. 30 last, the mill treated 47,855 tons, gold content of the concentrate exceeding copper considerably in value.

★Tests of surface gold ore for a prospective major-scale open-cut operation have been conducted with stripping and deep trenching equipment in the long-inactive Jessup district, in northwestern Churchill County, by Damon & Damon, father and son, the latter lately released from the Army. Trenching across 300 to 400 ft. of the belt of highly fractured silicified rhyolite, every fourth shovel load from the power unit has been loaded to truck and delivered

to a 50-ton concentrator at Toy, leased by the Damons from Don Burgner, of Reno, and 12 miles northeast of the Jessup property. The central claims have long been owned and prospected by Emil Stank, veteran miner who first opened the productive tungsten mines of the Nevada-Massachusetts Co., and the Jessup gold project was activated through the efforts of Miss Alma Dorothy Priester, who controls several gold and antimony properties in northern Nevada. If further mill tests warrant, the open-cut operation and large-capacity mill construction will be undertaken jointly by the High Divide and Thomson Divide mining companies.

★Early construction of a flotation mill at the Independence silver-lead-gold property on White Rock Creek, north of Tuscarora, in northern Elko County, is planned by W. C. Burns and associates, of Idaho Falls, Idaho. Opened by a 600-ft. crosscut tunnel and 200-ft. shaft, the mine was closed down in late 1941 and its reopening had been precluded by shortage of miners.

★Natomas Co., second-largest U. S. gold dredging concern, is preparing to operate a 5,000-cu.yd. dragline unit installed shortly before Order L-208 became effective, on its leased Greenan Placers, Inc., property below Copper Canyon in Lander County, embracing over 6,000 acres of tested gravel and alluvial detritus. C. E. McKay, dredge engineer for Natomas, directed the test work and installed the dredge.

★Fred Searls Jr., executive vice president of Newmont Mining Corporation, lately visited Goldfield, Nev., to inspect mine properties on which drilling has been conducted by the New Verde Mining Co., wholly-owned Newmont subsidiary now assembling equipment for shaft sinking. Searls is familiar with the district, having served as staff engineer for the Goldfield Consolidated Mines Co. in productive years.

★L. E. Whicher, 25 Broad St., New York, president of the Copper Canyon Mining Co., and Arthur Notman, mining engineer and a director of the Copper Canyon Co., are reported to be arranging a visit to the Nevada gold-copper property. Mr. Notman returned to his office lately from a trip to Singapore and mining districts in the Federated Malay States, where he investigated tin mines and resources for the U. S. government.

OREGON

Five iron ore deposits explored—Sunshine Company dredges operating on Burnt River

★Five iron-ore deposits near Scappoose, Oregon, explored by the Bureau of Mines in cooperation with the Geological Survey, U. S. Department of the Interior, are estimated to contain

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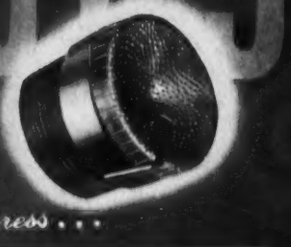

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Oregon *(continued)*

nearly 4,750,000 short tons of ore, Director W. E. Wrather of the Survey, recently reported. The ore ranges between 40 and 59 percent iron, with rather high phosphorus and some manganese, it was announced.

The Scappoose deposits, 25 miles north of Portland, although small, would be readily accessible to a plant for the manufacture of iron and steel in the Portland area, but to operate such a plant economically, an ore supply from other sources would be required to supplement the reserves at Scappoose. The orebodies average 5 ft. thick and are 5 to 160 ft. below clay and weathered basalt.

★Chemical Construction Co. has a new process for regenerating amonium sulphate at Salem. The plant there is now selling this sulphate to farmers for fertilizer. The process uses northwest clays.

★The old Continental mine, on the South Fork of Myrtle Creek, in Douglas County, has been leased by Edward Woodford, a Roseburg civil engineer, according to a report from the Oregon Department of Geology and Mineral Industries.

★Col. Frank M. Arthur and John Arthur have formed a company which has taken over the Argonaut mine, west of Baker, and plan to build a 50-ton mill.

★Operations have been resumed of the bucketline dredge owned by Sunshine Mining Co. and Western Dredging Co., on Burnt River and John Day River.

★Frank Klein has a small crew sinking a shaft at the Pyx mine, in the Greenhorn district of Grant County. He is operating for Young and Edwards, of Baker, and expects to continue through the winter. Chadwell brothers are cleaning out the old Magee mine, on Eagle Creek, and will sample the property.

★Ira Proud and W. A. Hilliard are directing the installation of a dragline dredge on lower Burnt River, in Baker County.

★Enterprise Mining Co., of Oakland, plans to test placer ground in Eagle Valley, Baker County.

IDAHO

Fire damages lower levels of Sunshine mine — Silver Summit to develop Chester vein extension

★Sunshine Mining Co. and the Big Creek Apex Mining Co. have entered into an agreement whereby Sunshine will develop the latter company's mining claims on a 50-50 production basis. Big Creek Apex is controlled by Sunshine Consolidated, which, in turn, is controlled by Sunshine. The Big Creek Apex ground adjoins Sunshine Consolidated on the south side-lines and Sunshine on the west end-line. Sunshine will reach the territory to be prospected with a 300-ft. crosscut from the 3,100 level.

An underground mine fire in the deep levels of the Sunshine mine closed all mining and productive operations in the mine during the last half of December. The fire started in a battery charging room on the 2,700 level, spreading from there through timbered raises to the 3,100 below and the 2,500 level above the battery room. Sunshine fire-fighting crews were aided by Hecla, Bunker Hill, and other mine crews of the district, and the U. S. Bureau of Mines safety cars and crews were rushed here from Butte and Salt Lake. The fire-fighters were greatly aided by a new type of breathing apparatus called the Scott Air-Pak, consisting of a Willson mask and a lightweight cylinder of compressed air, controlled by a demand-type regulator.

Workers have constructed a solid concrete bulkhead 40 ft. thick on the 3,700-ft. level between the fire zone and Jewell shaft and have filled this part of the workings with water to above the 3,100 level. A water pressure gage shows a pressure of 274 lb. on the 3,700 level and 16 lb. on the 3,100.

The concrete bulkhead isolated the western end of the Silver Syndicate workings developed through the Jewell shaft some 4,000 ft. west of the fire zone, and Sunshine will continue production and development from this area until the water can be pumped out of the zone damaged by fire. Enough of the Silver Syndicate west orebody has been opened up to allow the starting of at least two raises, in addition to continuing the drifts both east and west.

Method of reopening of the "Omega" and "Rotbart" areas of the Chester vein system will depend on the condition of the workings after the water has been pumped out. It may be necessary to drive a new crosscut from the 3,100 level a distance of 700 to 800 ft. to bypass the burned area.

Mine officials who have subsequently explored the 2,700 level reported that pouring water on the fire area and excluding air by means of bulkheads had proved effective. The fire damage was confined to an area about 100 ft. long on the 2,700 level, and the belief was expressed that the fire area on lower levels is not any greater. Officials who explored the Chester area on the east end of the 2,700 level found it undamaged by the fire. Water is now being pumped out of the lower levels and workmen are cleaning up the 2,700 level.

★Silver Cable Mining Co. has declared a dividend of 2c. per share on a capitalization of 1,250,000 shares, totaling $25,000, and payable Feb. 1 to stock of record Jan. 24. The Silver Cable mine is in Mineral County, Mont., just across the state line between Idaho and Montana, and is under lease to the Hecla

Mining Co., which has been producing around 80 tons per day of high-grade zinc-lead ore, which is hauled by truck about 17 miles to the Hecla mill, at Gem, Idaho. Hecla leased the property in 1943, and at that time Hecla engineers estimated that some 20,000 tons of ore had been blocked out ready for mining, which would average 5 percent lead and 15 percent zinc per ton, but. later developments greatly increased this tonnage. The mine is operated only during the summer months, because of snow conditions.

★An 800-ft. shaft sunk at the Atlas mine, at Mullan, Idaho, has proved that the Atlas ore has increased about 70 percent in silver values, compared to the lead content. Smelter shipments of ore from the lower tunnel and upper levels carried 0.25 oz. of silver to the percent of lead. On the 800-ft. level a drift has been extended easterly on the vein for a distance of 1,300 ft. and the vein crosscut in several places. At 150 ft. east of the shaft the vein showed a width of 6 ft. and assayed 0.75 oz. in silver, 4.38 percent lead, and 0.25 percent copper. Several hundred feet further east the vein measured 8.2 ft. wide and averaged 3 oz. in silver, 7.5 percent lead, and 0.17 percent copper. At the east end of the 1,300 ft. drift the vein was again crosscut, and, in addition to milling ore, showed an 18-in. streak of galena, which assayed 5.4 oz. in silver and 11.5 percent lead. The ore at this point showed small streaks of gray copper. The company is planning development west of the tunnel, where the vein shows strong outcrops of mineral on the surface. W. Earl Greenough has charge of the operation.

★The Silver Summit Mining Co., control of which was recently purchased by the Polaris Mining Co., has entered into a contract with the Yakima-Shoshone Mining Co. for the development of the Nellie vein from the bottom level of the 3,000-ft. shaft which the Polaris company is now financing and sinking in the Silver Summit property. The deal is on a 50-50 profit-sharing basis.

Yakima-Shoshone owns two claims, the Nellie and Emma-Nevada, which adjoin Silver Summit north side lines and which contain the acknowledged apex of the Chester-Silver Syndicate vein and fault system, which has developed extensive orebodies further west.

The Nellie vein has been quite a heavy producer of rich silver ore from tunnel levels. The natural south dip of this vein will carry it into Silver-Summit ground on lower levels, but this condition was not a factor in the deal. Yakima-Shoshone did not have the financial backing to sink to deep levels, where major orebodies may be expected; Polaris did have the backing and is already sinking the shaft. The Polaris company is, in turn, controlled by the Hecla Mining Co.

The Silver-Summit shaft is a model three-compartment opening which was completed by the original company to a depth of 1,500 ft., but was abandoned

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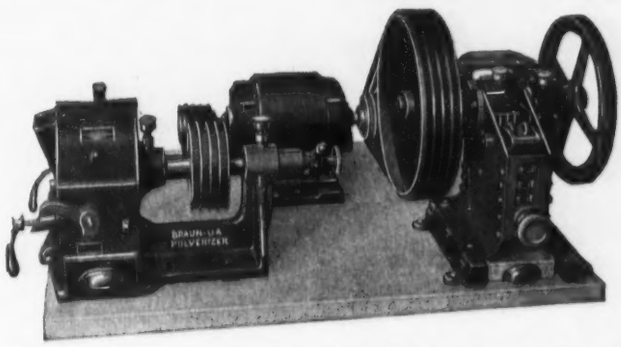

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Idaho *(continued)*

because of lack of further development funds, and allowed to fill with water. Polaris has pumped out the water and re-equipped the underground surface station with modern hoisting and air compressor machinery and is sinking the shaft at top speed with the aid of a clamshell bucket mucking device, which is the first application of such a machine in this district.

★The Alice Mining Co. has levied an assessment of one mill per share payable Jan. 15, with the delinquent sale set for Feb. 5, 1946. The Alice is an old producing mine, in Ruddy Gulch, halfway between Wallace and Mullan. Considerable high-grade lead-silver ore was shipped from the surface. Later the company built a 150-ton mill and operated the mine through a shaft development until the ore deposit apparently terminated on the Osburn fault. No work has been done in recent years.

★The old Garfield mine, in the Muldoon district, near Hailey, Idaho, which was a producer in early days, is being reopened by a group of Boise men. Since starting operations the new owners have been shipping a carload of crude silver-lead ore weekly to Salt Lake smelters and claim they will increase this production shortly to a carload a day. The ore is said to average 22 oz. of silver and 22 percent lead per ton. The Muldoon district is reported to be a highly mineralized area in which a Philadelphia company erected a custom smelter in early days, said to have been around 1882.

★The Lucky Friday Silver-Lead Mining Co. expects to complete its shaft development to the 1,400-ft. level by March 1. Work has now been completed for 270 ft. below the starting point on the 1,000-ft. level. The company has about 2,000 tons of high-grade silver ore stockpiled, which it is holding for a possible raise in the price of silver.

★The Sidney Mining Co., in the Pine Creek area of the Coeur d'Alenes, south of the Bunker Hill, has nearly completed a new 250-ton mill and expects to start operations about Mar. 1. The company is treating about 40 tons per day at a small pilot mill at its upper tunnel workings and is custom milling 50 tons per day at the Amy Matchless mill. The new Silver Dollar shaft development is down 500 ft. below the 1,800-ft. level starting point, where work was suspended before the company's participation in profits from the rich "Rotbart" area developed by Sunshine and Polaris companies in the so-called Chester vein system. Silver Dollar will extend its own shaft to the 3,000-ft. level, from which horizon it will drive a drift on the Chester vein about 2,500 ft. east of the Rotbart discovery and will also drift on the vein through Silver Chieftain ground, which adjoins Silver Summit's Yakima-Shoshone holdings on the east.

★Nevada-Stewart Mining Co., adjoining the Sidney and Highland-Surprise mine on Pine Creek, reports the discovery of a vein of zinc-lead ore containing 2½ ft. of high-grade and the same width of milling ore. Location of the orebody was first determined by U. S. Bureau of Mines crews drilling from the surface. The company attempted to open the vein with tunnel work but missed it, and again resorted to diamond drills and located the vein within 12 ft. of the tunnel face.

★Dividends for the Coeur d'Alene mining district were $4,046,334 for 1945, compared with $4,306,722 for 1944. The smaller dividend record is due chiefly to a lack of manpower. A record of yearly dividend payments for the district follows:

1929....	$5,144,990	1938....	$3,969,938
1930....	3,834,544	1939....	3,921,114
1931....	1,098,040	1940....	4,880,614
1932....	312,855	1941....	6,085,129
1933....	537,855	1942....	5,147,029
1934....	1,200,000	1943....	4,547,029
1935....	2,952,550	1944....	4,306,722
1936....	5,782,419	1945....	4,046,334
1937....	8,335,679		

WASHINGTON

Senator urges silver producers to be more alert—Alcoa turns over Mead plant to RFC

★Senator Hugh B. Mitchell, of Washington, informed silver producers, at a conference in Spokane on Jan. 9, that jewelers have been urging members of Congress to support lower silver prices, and recommended that silver producers be more alert in defense of their own cause. The Senator added that jewelers might be satisfied if Government seniorage on silver is reduced to 29c. an ounce, which would leave producers $1 an ounce. He displayed a telegram from R. J. Reynolds stating that stockpiling is needed to insure an adequate reserve of strategic materials. The telegram stated that this might enable Reynolds to operate one or more of the aluminum plants in the Northwest which are now idle.

★G. L. Stump, office manager in Spokane for Aluminum Company of America, is winding up the affairs of that company in the Northwest. The company's Mead reduction plant is being turned over to the RFC. Representatives of General Machinery Co., of Spokane, have been maintaining the plants, and are assisted by representatives of the U. S. Treasury in guarding treasury silver in busbar installations. About 50 men have been held at the magnesium plant on a standby basis by Electro-Metallurgical Co. The plant has been declared surplus by the Surplus Property Board.

★Engineers of Permanente Metals Corporation, of Oakland, of which Henry J. Kaiser is president, have completed an engineering survey of the Spokane

aluminum and magnesium plants, according to D. M. Baird, assistant regional engineer for the Defense Plant Corporation. Baird said many representatives of other companies have inspected the properties.

★J. S. Crandell and Evelan Backman, of Spokane, and L. L. Wartes, of Yakima, have incorporated the Aero-Centric Flotation Co. to manufacture and sell a new type of flotation equipment.

★The superior court of Spokane County has approved the dissolution of Marsh Mines Co. and Gertie Mining Co., the properties of which are being acquired by King Mining Co., of Wallace, Idaho. The properties involved are in the Coeur d'Alenes.

★Alder Mining Group Co. has again been in the courts in Spokane on a petition asking a ruling as to how the $27,297.31 in the hands of a receiver should be distributed. The property is a gold mine in Okanogan County.

★Eskil Anderson exhibited at the mining convention at Spokane in December a hundred cut and polished pieces of jade which he collected in the vicinity of Jade Mountain, 250 miles northeast of Nome, Alaska. Anderson is a mining engineer with the Alaska Department of Mines.

★Howe Sound Co. paid a 40c. dividend Dec. 21 to stockholders of record on the 14th. The company paid this same amount of $198,200 in September. In each of the first two quarters of 1945 the company's payment was 30c. a share, making a total for the year of $1.40 a share, or $696,724.

MONTANA

Gold discovery at Jardine mine is reported—New placer operations are under way

★A 50-ton selective flotation mill designed to produce both lead and zinc concentrates has been built on the Silver Butte property, near Libby. Ore from the mine is expected to run about 6 percent lead and 4 percent zinc, with 5 or 6 oz. of silver to the ton. The mine is opened by two adits, and has about 3,000 ft. of underground workings. Underground workings have been rehabilitated, and the company plans to begin production in spring. The property is owned by William Curts, and is under the direction of Andrew Prader, of Spokane.

★It is reported that the Jardine Mining Co. has discovered rich, free-gold ore east of the Bear Gulch fault, at a depth of about 400 ft. below the surface. This discovery was made as a result of an exploratory diamond-drilling program, which is now being conducted. This is the first free gold ore found east of the fault. Most of the ore produced in the Jardine property

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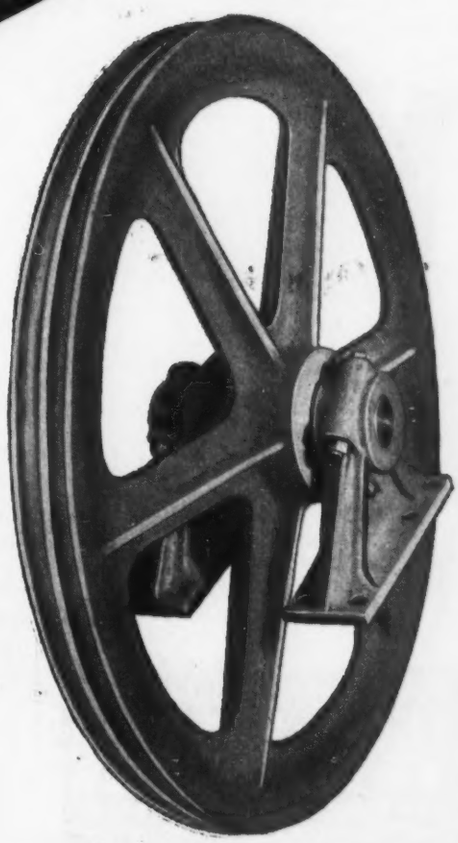

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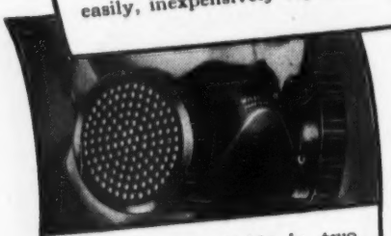

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Henry Kasman, who has been a placer miner for 40 years, pans colors from gravel being excavated for a building on the main street of Helena, Mont. Spectators include Mayor J. J. Hatin (right foreground). W. R. Wells, dredgemaster for Porter Brothers' dredge, estimated that the gravel would run $1.75 per yard. However, as in the case of other Helena buildings, concrete was poured right over the pay dirt.

Montana *(continued)*

has been of a complex sulphide type, made up mostly of pyrite and arsenopyrite. Samples of ore from this diamond drill hole are said to assay as high as 11 oz. of gold per ton. The Jardine mine is near Gardiner, Park County.

★In response to a request by Governor Ford, Dr. Francis A. Thomson, director of the Montana Bureau of Mines and Geology, has prepared "A Preliminary Inventory of Montana Mineral Resources," the first installment of which has appeared in a newsletter by the Mining Association of Montana.

★Troy Mines Co. was recently purchased by E. E. Drury, Jesse Ellis, J. N. Boyd, and Donald Pattie. The company controls the Snow Storm mine, a silver-lead property near Troy, Mont.

★The Moorlight Mining Co. was recently acquired by the Taylor-Knapp Co., which has had mining interests in Montana for several years. The Moorlight mine, in the Philipsburg district, has been the most important producer of battery-grade manganese ore in the United States for many years.

★In an attempt to lower industrial accident insurance rates, the Mining Association of Montana has formed an Industrial Accident and Safety Committee, with J. C. Archibald as chairman. It is hoped that accidents can be reduced by a statewide program of education stressing safety and accident prevention.

★The Minah mine, in the Wickes district, has been taken over by the Nugent Brothers, of Coeur d'Alene. Two shifts have been working to clean out the lower adit and gain access to the orebodies. Norman Rogers, of Rimini, has been awarded a contract by the U. S. Bureau of Mines to bulldoze trenches for an exploration program. The Bureau also plans to diamond-drill the property. Project director is Robert D. O'Brien. The Minah property is credited with having produced over $2,000,000 in silver and gold.

★The 4-ft. Yuba dredge on Henderson Creek, Granite County, is said to be one of the few gold dredges in the country to operate throughout the war. Besides producing gold, this dredge saves substantial amounts of tungsten and for this reason was allowed to operate in spite of L-208. W. A. Noon is manager of the H & H Mines, which operates this dredge.

★The Montana Leasing Co. is shipping silver-lead-zinc concentrates from the Lexington mill, near Neihart, Mont. Clayton Keane, of Wallace, Idaho, and J. A. Allen, of Spokane, Wash., operate the company. Scott Palmer, of Helena, is manager.

★Two new placer operations are getting under way in the famous old Alder Gulch diggings near Virginia City. A portable washing plant is being installed on the Franklin Lease by H. L. Bracken, of Salt Lake City, Utah. Another portable washing plant has been installed on the Pharmer lease by H. E. Millan, of Farmington, Iowa. Testing

operations for deep channels are being carried on below Virginia City by M. B. Nichols.

★P. V. Jackson was elected president of the Madison County Mining Association at a meeting held recently. He succeeds K. D. Lynn. Principal speakers for the evening's program were Oscar A. Dingman and Dr. E. S. Perry, of the Montana Bureau of Mines and Geology. The Bureau's program for aiding prospectors and small operators in the search and development of minerals was outlined. Dr. Perry stressed the importance of non-metallics, and told of recent field work done by the Bureau. Carl Trauerman, secretary of the Mining Association of Montana, and E. M. Tittman, manager of the A.S.&R. smelter at East Helena, also contributed to the discussion.

ALASKA

Bureau continues asbestos exploration—Fires destroy property at Fairbanks and Cordova

★Work of the Alaska Miners' Association was reviewed by Charles J. Johnston at meeting of the association held in Seattle on Jan. 3. Al Anderson, secretary stated that the association was striving to make a survey of losses which might be compensated if the Engle relief bill passes Congress.

★Clyde Day, head of the Day Navigation Co., recently reported that several operations in the Flat district are ready to start mining in spring. Alex Mathison and the Riley Investment Co. each have dredges, and others will operate with tractors and draglines.

★The Alaska Division of the Bureau of Mines is continuing exploration for asbestos which was started two years ago. A 5-in. core drill has been imported. Tremolite asbestos is being mined by the Arctic Exploration Co. in the Kobuk district. Two Bureau engineers have also been working in the Aleutians and on the Peninsula, and others are working in the Copper River area and on Glacier Creek, a tributary to Chitistone Creek.

★J. McDade and Afe Brown report a gold strike on their property on Victoria Creek, a tributary to the Nanson River. Assays are reported to run from $65 to $200 across 2 ft. of the vein. A second location on the same property is reported to carry gold to the value of $45 across 40 ft. The location is 12 miles east of Mount Freegold, in the Dayson Range.

★On Jan. 5 Fairbanks experienced the most destructive fire since the town was wiped out in 1906. Of unknown origin, the fire destroyed part of the main business district, with an estimated loss of $400,000. Rebuilding will take place in the spring.

★Northland Mines, Inc., has relin-

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Alaska *(continued)*

quished the option on the South Fork Mining Co. ground on the south fork of the Koykuk River. The option was for one month only, which did not offer sufficient time for check drilling during the winter. The South Fork Mining Co. plans to continue operations next summer.

★The last of the terminal facilities of the old Copper River & Northwestern Railroad at Cordova went up in flames just before the first of the year. About a quarter billion dollars' worth of copper was hauled over this line from the Kennecott mines before the mines were closed in 1938. The roundhouse and other buildings had been used during the war by the Army under a lease from the Department of the Interior.

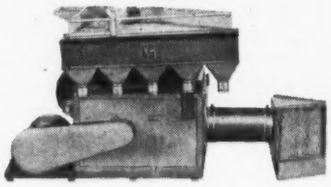
CANADA

Employment rolls increase—Britain contracts to buy Canadian refined copper—Quemont diamond-drills through ice

★During the six years of war Canada produced nickel, copper, lead, and zinc to a total value of close to $1,000,000,000, according to a report by the Hon. J. A. Glen, Minister of Mines and Resources, Ottawa. Nickel output was about 816,000 tons, 80 to 85 percent of Allied requirements; copper, 1,800,000 tons; lead, 1,300,000; and zinc, 1,600,000. Of the total output, Canada exported 80 percent or more to the United Nations, amounting to about 4,600,000 tons of the four metals. Peak production was secured in 1942, when the total volume of these metals was ten times greater than in 1921. Canada's non-metallic output in the war period had total value of about $1,000,000,000 and curtailed gold recovery was about $978,000,000. Asbestos was close to 2,600,000 tons; gypsum, 5,500,000 tons; and salt, 3,410,000 tons. Close to 40 percent of the aluminum used by the United Nations was produced at Arvida, Quebec, from imported bauxite.

★A year-end appraisal of Canada's international position shows that a stabilized domestic economy and great natural wealth have placed the country in a unique position for postwar expansion. Aside from the implications of large resources of uranium and the consequent position of authority in world councils, Canada has developed under a stabilized government to a strong political and financial position which is favorable to continued growth of industry and foreign trade. The abundant cheap electric power that made possible the great wartime aluminum output is now available for new and enlarged industrial facilities. Good transportation is available and new highways are under construction which

Striking Developments
of
AIR SEPARATION
during the war effort



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Canada *(continued)*

are planned to make accessible Chibougamau and other known areas awaiting exploitation of rich mineral deposits. More men are becoming available for getting out the ore that was held in abeyance through the war years.

★The British Ministry of Supply in January contracted for the purchase of up to 30,000 short tons of refined copper from Canadian producers, for delivery within the next six months. Provision was made for increasing the tonnage if metal is available, the price being fixed at 13.5c (Canadian), delivered at British ports. This is the first deal for Canadian copper to be negotiated within the past year. Market outlets for Canadian zinc are proving satisfactory, but lead supplies were short at year end. It was announced that Canada's lead output would be increased above the 172,728 tons produced in 1945. Consolidated Smelters is the major producer.

★The employment situation in the Canadian mining industry at the beginning of November 1945, as reported to the Domininion Bureau of Statistics by 505 operators having 15 or more employees, showed a combined working force of 68,835, compared with 67,687 reported in October. The index of employment was 146.1, compared with 149.2 in the same month a year ago. In the same period, the payroll index dropped 4.1 percent.

QUEBEC

★Greater activity in the Quebec mining industry than ever before in its history was reported by the Hon. Jonathan Robinson, Provincial Minister of Mines, to the Montreal branch of the Canadian Institute of Mining and Metallurgy. The best assistance to private enterprise was stated to be road construction for the purpose of opening inaccessible areas. For such work the Province had spent $600,000 in the past year. A road system was planned to and along the minerals belt of northwestern Quebec, beyond the transcontinental railway. Carrying out this project was stated to require Federal assistance with two-thirds of the financing.

★Quemont Mining Corporation has expanded the scale of exploratory work in investigating what has been described as Canada's major copper discovery since the early work at Noranda. Eight diamond drills are now working from the ice at the north end of Lake Osisko and another drill is underground. The long drift on the 900-ft. level is pushing steadily to reach the new ore at the rate of two rounds a day, with about 400 ft. to go before intersecting high-grade copper ore that was located by the Koulomzine magnetic survey. The drift has been breaking into sulphides which are believed to offer new ore possibilities. Ice conditions are expected to allow continuing the drilling project through March, with a projected total of 30,000 ft. in 30 drill holes.

★The base-metal property of East Sullivan Mines, Bourlamaque Township, is reported to indicate 10,000 tons of ore per vertical foot to a 500-ft. depth, based on drill exploration. George Dumont, mine manager, reports a grade averaging $9 per ton, chiefly in copper but including zinc, gold, and silver. Shaft sinking is being planned, the work to start when the present building program is completed. Three diamond drills are continuing exploratory work. A transmission line has been run to the property and the new road is expected to be completed soon. Expenditures have amounted to $145,221 including $116,296 for drilling.

ONTARIO

★Mineral production in Ontario last year was estimated at $200,000,000, compared with $212,755,354 in 1944, as reported by the Minister of Mines, Hon. Leslie M. Frost. "There is hope that the demand of peacetime industry will result in a further increase of nickel-copper production. At no time in the history of Ontario's gold mining has more capital been available for development work," it was stated. In the first eleven months of 1945 gold output was valued at $53,656,778, compared with $59,298,520 in the same period of 1944.

★In the Patricia and Thunder Bay districts, western Ontario, nine properties produced gold last year, compared with eleven in 1944. The estimated output was valued at $7,168,738, compared with recovery in the previous year of $10,646,033, as reported by the Dominion Bureau of Statistics. Plans to resume production were announced by several mines that closed down as a result of the war labor shortage. These include MacLeod-Cockshutt, Hard Rock, Magnet, Undersill, and Jason. Dickenson Red Lake Mines announced plans for sinking a shaft to 500 or 600 ft. and for the purchase of a complete mining plant. Work is to be started after the break-up next spring. L. O. Foster is Dickenson's mine superintendent.

★At Pickle Crow Gold Mines, the No. 3 shaft, on the North zone, had reached a depth of 1,520 ft. in January. The objective is 1,600 ft., when lateral work will start. In the main mine workings, diamond drilling has been started from a crosscut on the bottom 2,450-ft. level to test the Howell vein at lower horizons. Previous tests at a depth of 2,700 ft. intersected $21 across a 4-ft. width. This vein, at a depth of 2,075 ft., has been developed for a length of 425 ft., averaging $9.80 per ton. A. G. Hattie is mine manager.

MANITOBA

★The annual report of Northern Canada Mines, Ltd., for the fiscal year ended Sept. 30, details the work done

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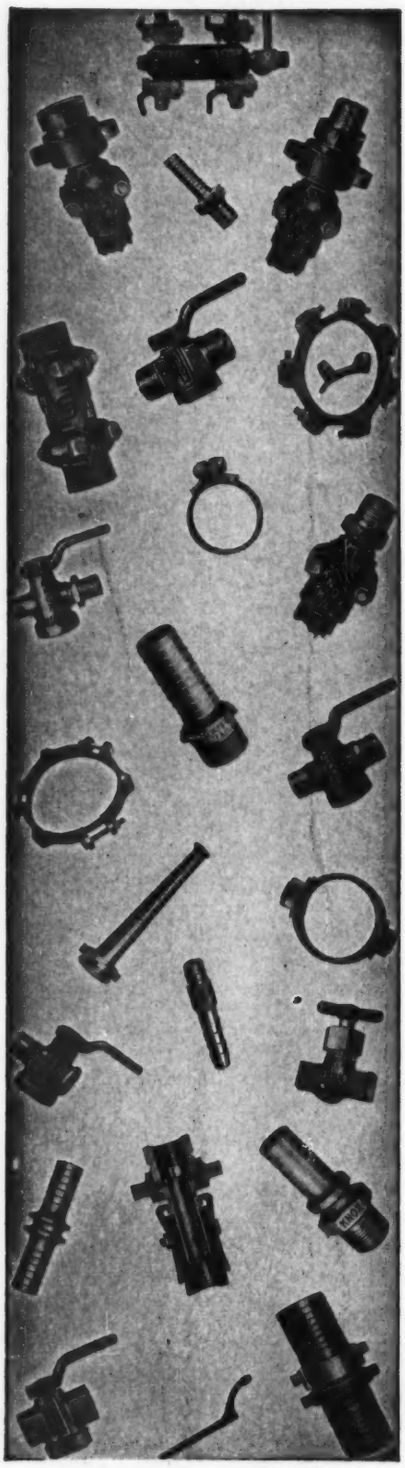

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Canada (*continued*)

during the past summer in the Snow Lake area, jointly with Pioneer Gold Mines of B. C., Ltd. Exploration of the several groups included geological and geomagnetic surveys, trenching, and X-ray diamond drilling. Latterly work has been concentrated on the Snow group, adjoining the Howe Sound property on the northwest. A new company, Koona Lake Mines, Ltd., is being formed to explore a portion of this group. To date eleven zones have been discovered which warrant further investigation. Eight diamond-drill holes put down on the How-Ern group, on the south shore of Three House Lake, cut narrow quartz veins, some of which carry appreciable amounts of gold. However, the occurrence appears to be lenticular in character, and no orebody is indicated. At Morgan Lake, 11 miles southwest of Snow Lake, 36 holes with a total footage of 8,049 were drilled. Irregular zones of mineralization were cut, but in general the values were low. One section 360 ft. long, with an average width of 2.1 ft., gave an over-all average from diamond-drill and surface sampling of 0.59 oz. per ton. Work on this group is being discontinued for the present.

★A sizable staking rush has developed in the Little Stull Lake area on the Manitoba-Ontario boundary, despite seasonal transportation difficulties. Upwards of 300 claims are reported to have been staked as a result of interest in the Ken Bay Mines, Ltd., discovery. Pioneer Gold Mines of B.C., Ltd., Coniagas Mines, Ltd., and Anson Cartwright Mines, Ltd., are reported to be included in the stakes.

BRITISH COLUMBIA

★General improvement in the mine labor situation is reported by most operators. Temporarily, however, the shortage of skilled miners has resulted in a cessation of hiring of unskilled men in local areas. Efforts are being made to relieve housing shortages, particularly for married men with families.

Britannia Mining & Smelting Co. reports that 132 men were added to the payroll during the past four months. Approximately 400 additional employees will be required to bring the crew up to full strength. Increased output is expected during 1946.

The number of men employed underground at Bralorne Mines, Ltd., now exceeds 250, and it is expected that the prewar employment figure of approximately 300 will be attained shortly.

Employment at Cariboo Gold Quartz Mining Co. has risen steadily during recent months and resumption of the large-scale underground development is being considered.

Improvement in the labor situation is reported from Granby Consolidated Mining, Smelting & Power Co.'s Copper Mountain operations and from those of Bayonne Consolidated Mines, Limited.

★Revival of operations at the Twin "J" property, Mount Sicker district, Vancouver Island, is indicated in a recent company statement. Exploration is planned, based on new theories as to the nature and extent of Twin "J" orebodies. An option to purchase the mining and milling plant, including the 150-ton mill installed by Wartime Metals Corporation in 1943, has been secured by a group of former shareholders of Tyee Consolidated Mines, Limited.

★A diamond-drill intersection obtained on the Marble Bay Mining Co.'s property adjoining the Pioneer-controlled Vananda operations on Texada Island gave a width of 22 ft. of ore with an over-all assay of $12.21. S. M. Barrowman, managing director, states that the intersection was obtained in a hole drilled from surface at a length of 155 ft. Values were $9.50 in gold, 1 percent copper, and 0.50 oz. silver per ton. One 6-ft. section of the core assayed $30 per ton. Subsequent drilling will be directed towards determining the extent of the new orebody which has been contacted.

★During the ten-month period, February to November 1945, 10,462.08 oz. of gold valued at $402,790.08 was produced by Cariboo Gold Quartz Mining Co. from 27,439.4 tons of ore milled. For the three-quarter period ended Oct. 31, 1945, net loss was $160,518.29. Working capital at the end of the three-quarter period was $360,510.86, compared with $411,165.77 on Feb. 1, 1945.

★Major participants in the newly formed Barkerville Mining Co., Ltd., include Pioneer Gold Mines of B.C., Ltd., Leitch Gold Mines, Ltd., Transcontinental Resources, Ltd., and W. B. Milner. Present holdings of the company are 95 claims and fractions in the Barkerville district of the Cariboo mining division.

★During 1945 copper production at Granby Consolidated Mining, Smelting & Power Co.'s Copper Mountain operation amounted to approximately 13,800,000 lb. Average price received was 13.3c per pound. All concentrates were shipped to Tacoma for treatment. A new contract has been arranged under the terms of which Granby production will continue to be shipped to Tacoma for at least the next two or three years. Effective Oct. 1, 1945, the agreed price under the new contract is 11.7c per pound.

★Diamond drilling on the 3,700 level at Hedley Mascot Gold Mines, Osoyoos district, has revealed existence of an extensive high-grade orebody. Dr. Victor Dolmage, consulting geologist, stated that the first successive samples taken assayed 6.8 oz. of gold across 18 in.; 1.25 oz. across 2.5 ft.; 2.9 across 5 ft.; 1.3 oz. across 6 ft.; and 1.62 oz. across 5 ft. The first 15 ft. averages 1.70 oz. of gold per ton, exclusive of the first 6.8 oz. sample.

MEXICO

Copper producers seek new Metals Reserve contracts—Interest renewed in abandoned silver properties

★Mining in Mexico is considerably snagged by the strike called Dec. 31 against 28 of the 32 silver producers and five large refineries. But, the Mexico City Stock Exchange declared that the strike has not affected mining shares, least of all those of silver companies. El Amparo, Guanajuato, La Occidental, Jalisco, La Natividad y Anexas, Oaxaca, and El Fenix, Camp Morado, Guerrero, were spared the strike by making agreements with the silver labor bosses. El Amparo, the labor leaders revealed, allowed a 10 percent pay raise, with the provision that if the Mexican Government subsidizes silver production or if the price of the metal in the U. S. is again increased, it will meet the demanded 40 percent boost. The strike, according to reports from Pachuca, Hidalgo, is costing the state 50,000 pesos ($10,125) a day in lost taxes. Hidalgo is the home of the world's greatest silver mines.

★Several mines, with ore containing high silver values, in the San Juan de Guadalupe and Sierra de Ramirez districts, Durango, that were abandoned because of their low grade, are to resume working in February, announces the Ministry of National Economy. Owners consider that these mines will now be profitable because of the higher price of silver. Several mining men have applied for concessions to some of these mines.

★The Confederation of Chambers of Commerce in discussing the future of copper mining in Mexico declared, in substance, that the only hope for the industry will be the success of certain mining companies' negotiations with Metals Reserve to renew purchasing contracts in part or in full, plus retention of the subsidy allowed during the war to encourage prompt delivery. The free market, the high U. S. duty (4c a pound), no subsidies from private buyers, are bad for copper mining in Mexico, the Confederation said.

★Lead exports to the U. S. are continuing on a large scale. National Railways report that currently they are moving an average of ten carloads of lead daily across the border from the plants in the Monterrey district in Nuevo Leon. The railroad also reports that it is moving much Mexican iron to Tampico for shipment to Europe.

★Monthly shipments averaging 3,000 metric tons of zinc concentrate and 1,000 metric tons of lead concentrate from its mill are being made by the Eagle-Picher Mining & Smelting Co. Harold T. Blackwood is manager of the Minas de Guerrero, S. A., in Oaxaca. The mill capacity is 800 tons daily. Though this operation of Eagle-Picher was part of its war work, it is intended to carry on the operations at full capacity. Minas de Guerrero ore contains mostly zinc and lead values, and little gold and silver. Five tunnel levels are being worked. The company is now surveying other properties in Mexico with a view to working them.

★President Manuel Avila Camacho has asked Congress to kill the presidential decree of Dec. 31, 1943, demanding that metal-treatment plants must get new franchises to continue functioning.

★The Ministry of National Economy has announced good results of the examinations made by six brigades of the Committee for Investigation of National Resources in the mining zones of Zacatecas, Hidalgo, Guanajuato, Sinaloa, and Sonora and the State of Mexico, and in southern Baja California. The Committee also has checked on mines and metal-treatment plants of the Sociedad Cooperativa de Produccion de Minerales, "Mineral del Rincon," a mining cooperative functioning at Temascaltepec, State of Mexico, and helped the Cooperativa Minera Dos Estrellas, which has been working properties at El Oro, Mexico, and Tlalpujahua, Michoacan. The Ministry declared that this aid was in line with Mexico's policy of cooperativism. Selection of sites for the establishment and stimulation of mining and of metal treatment plants catering mostly to prospectors and other small-scale miners is another objective. The establishment of electrolytic copper plants in various parts of Mexico is also being given attention.

★Loss of wartime copper contracts with Metals Reserve has forced the Cia. Minera del Boleo, S.A., the French-owned copper mining enterprise that functioned for many years at Santa Rosalia, Baja California, to prepare for the definite suspension of work. The Labor Ministry is informed nearly 2,500 workers must be dismissed. It is reported that many of these people will be employed in other mines.

★The Cia. Fundidora de Fierro y Acero de Monterrey, S. A., Monterrey, Nuevo Leon, Mexico's principal iron and steel works, is soon to install a rolling mill at a cost of 10,000,000 pesos ($2,150,000). The plant is expected to be in operation by August.

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CHILE

Nitrate industry seeks world markets—National technical institute organized—Compulsory coinage of silver sought

★The future of the Chilean nitrate industry, and problems relating to the possibility of enlarging its present markets, are now being considered. As

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Chile *(continued)*

a scarcity of fertilizers is a major European problem, the Chilean nitrate industry has sent a delegation to Europe composed of Messrs. Horace Graham, de Castro, and Alvarez, representing, respectively, the Anglo-Chilean and Lautaro Nitrate companies, the Cia. Salitrera de Tarapacá y Antofagasta, and the Nitrate & Iodine Corporation, to investigate the possibilities of European markets.

Chile is determined to sell the greatest possible quantities of its fertilizers in the world's markets. To reduce costs, loading is being mechanized at the ports. Nitrate companies are investing in new machinery and spares which they could not import during the war.

Before the war, Chile produced nearly 10 percent of the world's requirements of nitrogen fertilizers, and this is the minimum quota Chile hopes to be able to retain.

The future of the synthetic German nitrogen industry has also been a subject of speculation here. Germany was capable of producing 1.5 million metric tons of nitrogen per year in 1939, but during the war output was cut down to about a million tons, and excess capacity was turned over to other more essential requirements. It remains to be seen whether Germany's nitrogen industry is cut down to its own fertilizer needs.

The United States used to complete its own requirements of nitrogen by importing from Chile 20 percent of its total needs. However, during the war plant capacity has been more than doubled, and if in the future this new capacity is used to the full, Chile's exports to the States may receive a hard blow.

★Recommended by the First Pan American Congress of Mining Engineers and Geologists held in Santiago in 1942, the National Institute of Technological Investigations has recently been organized in Santiago by the Chilean University with the joint collaboration of all the engineering societies. The Chilean Technological Institute plans to investigate the country's raw materials and their utilization in industry, and to provide government or private industry with data on new technical problems. It will also look into the standardization of products and the distribution of scientific and technical publications.

★Recently the Executive sent to Congress a bill to give silver a greater value within the country and to make compulsory the coinage of silver by the Chilean mint. According to the main provisos of this bill, the new price of silver will be equivalent to 1.29 dollars per ounce. The mint will coin twenty- and ten-peso silver pieces, which will contain 20.0 and 10.0 grams of fine silver respectively. The government's bill limits buying to twenty metric tons of silver.

Mining circles which approve of price to be paid for the metal disagree with nearly all of the rest of the clauses of the bill. Miners argue that twenty tons of silver will be produced and bought in a maximum period of four to five years and that this length of time is altogether too short for most mining enterprises to amortize their capital investment. Therefore, the miners, through the Chilean Mining Society, are asking that the buying of silver by the Government be for an indefinite period of time.

★Recently a delegation of miners from the Coquimbo Province visited the President of the Republic at Santiago to discuss the possibility of smelting the ores from Atacama and some from Coquimbo, in the Potrerillos smelter of the Andes Copper Co., the bill which increases the internal value of silver; and Government help to the small mining industry by decreasing taxation and social security laws.

★To develop new gold mining camps, the Ministry of Economy has decided that engineers from the Bureau of Mines, Corporacion de Fomento, and Caja de Credito Minero should investigate promising gold districts, so remotely situated from the railroads and main roads that the ores cannot be shipped to the Caja's agencies or mills. Such promising districts will be furnished with amalgamating mills of from 10 to 15 tons' capacity per day. At present such ores will not bear freight to mills or railroad depots.

★Oil has been struck in the Springhill drill hole of the Magellan Province, the most southern of Chile, where geophysical methods were used to find favorable oil structures. The Springhill project is part of the systematic exploration being carried out by Corporacion de Fomento (Chilean counterpart of the R.F.C.) in Tierra del Fuego, Magellan Province. Oil was struck at a depth of 7,438 ft. Drilling started Sept. 22, 1945. Present flow from the hole is approximately 52.5 g.p.m.

PHILIPPINES

Gold properties in Surigao and Mindanao plan to resume—East Mindanao property completely ruined by Japs

★Inspection of the three principal mines in the Surigao district, Mindanao, reveals that destruction of the surface plants has been nearly complete. At the Mindanao Mother Lode gold mine, formerly largest gold producer in Mindanao and milling in 1941 the richest gold ore in the Philippines, three bombs had been dropped on the camp, which hit the mine office, the assay building, and the mill, all of which were in close proximity. All buildings were burned. The power plant was destroyed. Some of the solutions tanks in the mill remain, but are in bad condition and can hardly be

salvaged. The main haulage tunnel is caved from 100 ft. in from the entrance, and all mine workings below the drainage level are flooded, with their condition unknown. The road to the mine is passable, but the bridges are unsafe. A small crew of men is engaged in cleaning up and salvaging. Larry Smith, former mine superintendent, is on the ground directing operations. It is reported that plans are under way for rebuilding the mill and resumption of operations as soon as possible, and $500,000 has been allocated for this purpose by the company.

East Mindanao, formerly a regular producer in the Surigao field, is completely ruined so far as its surface plant is concerned. All buildings are destroyed, and the mill machinery and power plant were removed by the Japanese. No plans have been announced for resumption of operations.

At the Surigao Consolidated mine, formerly an important operation about 50 kilometers south of Surigao, conditions appear a little better but are still deplorable. All galvanized iron roofing was removed from the buildings, and such machinery as remains is badly damaged from the weather, as well as having been looted of all small parts. Five of the diesels are in place at the power plant, but essential parts are missing. Shafts Nos. 1 and 2 are caved, but No. 3 appears in better condition. It has been announced that the company is placing contracts in the United States for a new mill.

At the North Mindanao property, where a gold by hydraulicking operation had been going on for many years with fair success, the pipe for bringing high-pressure water from the reservoir to the gravel pits is gone, and the dam is ruined. However, sluicing can be resumed here without much delay when the damage is repaired.

AUSTRALIA

Broken Hill activities reviewed—Mount Morgan production is reported

NEW SOUTH WALES

★Although Broken Hill South, Ltd., by reason of the pitch of the orebody, taking it into the leases of Zinc Corporation, Ltd., on the southern side, at depth, will be the first of the three great mines at Broken Hill to cease operations, the mine has still a substantial life before it. In the year ended June 30, 1945, the company made profit of £263,981 from mining and £80,507 from investments. Dividends totaling £240,000 were paid to shareholders. After the Broken Hill Proprietary Co., and the Sulphide Corporation, Ltd., owner of the Central mine, finally ceased work, their leases passed to Broken Hill South, Ltd., and during the year extraction of remnant ore in

The diagrammatic drawing shows how heavy Safety Doors in a large metal mine are closed quickly, by means of air cylinders. Sections of a shaft may be sealed off instantly and positively, if necessary.

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Australia (*continued*)

three of the old mines of the field was started. In the Central Mine, at the 1,100-ft. level, a residual block of ore has been made ready for stoping by a winze connected with the South Mine workings, and the Kintore shaft is being re-equipped with headframe and electric hoist in preparation for the extraction of remnant ore in the upper levels. Kelly shaft, on the old Block 10 mines, is being reconditioned to the 415-level to permit entry into the upper level. In the leases of Broken Hill South itself, 2,315 ft. of development was completed. On the 1,940-ft. level a lode was proved which was larger than expected. To determine its shape, the sill floor was stoped, and, since then, driving on the orebody has been continued. No. 7 shaft was sunk to 22 ft. below the 2,100-ft. level. Diamond drilling totaled 1,610 ft., bored on various levels below the 1,940-ft. level. Ore reserves were estimated at 1,930,000 tons exclusive of ore disclosed by diamond drilling or by limited developments. A conservative estimate of ore developed between the 1,630-ft. and 1,940-ft. is included. In the year under review milling results were as follows: Crude ore milled, 309,605 tons averaging 13.7 percent lead, 7.1 oz. silver, 12.7 percent zinc; lead concentrates produced, 53,612 tons averaging 75.8 percent lead, and 37.9 oz. silver; zinc concentrates, 67,400 tons averaging 52.4 percent zinc. Employees on surface numbered 359 and underground 530. Wartime production from the Broken Hill mines, through the smelters at Port Pirie, South Australia, was 1,150,000 tons of pig lead, 40,000,000 oz. of silver, and zinc concentrates representing 700,000 tons of recoverable zinc metal, and important quantities of antimony, cadmium, and copper. Sulphur from the roasting of zinc concentrates was utilized in the manufacture of sulphuric acid for fertilizers and explosives.

QUEENSLAND

★Mount Morgan, Ltd., ended the year June 30, 1945, with a net profit of £51,846. Shortage of manpower caused drastic alteration in the mining program and the temporary closing of the No. 2 mill, as well as reducing the rate of overburden removal. Total material mined in open-cut operations was 1,320,310 tons. Of this output 576,448 tons were milled and 743,862 tons were discarded as waste. The sulphide ore averaged 2.72 dwt. gold per ton and 0.67 percent copper. The quantity of ore mined and treated from outside estimated ore reserves comprised 46.45 percent.

Tons milled were 549,350. Average assay of heads was 2.72 dwt. per ton and 0.67 percent copper. Concentrates produced totaled 31,511 tons averaging 25.4 dwt. gold per ton and 10.0 percent copper. Metal produced during the year included 40,928 oz. of gold and 3,070 tons of copper.

AFRICA

Large development programs planned — Two Witwatersrand properties to shut down

★Announcements made by various mining companies indicate that large capital expenditures will be made for development programs as soon as men and material are available. Recently West Dreifontein started on its initial capital program, and Blyvoor has raised more capital for the exploitation of rich deposits in its claim area. Libanon is to reopen, and its capital will also be increased.

On the East Rand Marievale is scheduled for a new shaft, and Spaarwater, which stopped work in 1940, must eventually resume operations.

Additional shafts are being sunk at VanDyke, Vlakfontein, and Vogelstruisbult, and on Central Rand a subvertical shaft is being sunk on E.R.P.M.

On the West Rand, Luipaardsvlei is expected to engage in additional shaft-sinking work.

★Deeper areas of the Rand Leases property are being made accessible for mining. It was stated at a recent annual meeting of the company that capital expenditures entailed were estimated at £1,000,000 and would be spread over the next four years. For the year ended June 30, 1945, tons milled were 2,271,000, average yield per ton was 3.908 dwt., and development work totaled 58,991 ft.

★Venterspost G. M. Co. has announced that for the year ended June 30, 1945, tonnage milled was 1,090,000 tons, gold produced was 237,607 oz.; yield per ton was 4.360 dwt., and working costs were 28s.4.1d. per ton milled. Development work totaled 53,841 ft., and footage sampled amounted to 26,620 ft.; of which 12,295 proved payable at an average value of 5.5 dwt. over a stoping width of 69.4 in. Ore reserves as of June 30, 1945, were estimated at 2,070,000 tons averaging 5.2 dwt. over a stoping width of 68.8 in.

★The Nigel Gold Mining Co. announces that a winding accident occurred at No. 2 shaft on Nov. 20. No lives were lost.

★The directors of Central South African Lands & Mines, Ltd., announce that the company has purchased a controlling interest in the Afrikander Lease, Ltd., which company has been operating successfully in the Klerksdorp district since 1922.

★A tender of £137,000 has been made by New Central Witwatersrand Areas, Ltd., for the reduction plant, mining machinery and equipment, new stores and buildings of the New Machavie Gold Mining Co., and has been provisionally accepted by the directors.

★There were 40 fatal accidents in the gold mines on the Witwatersrand and its extensions during October, 1945,

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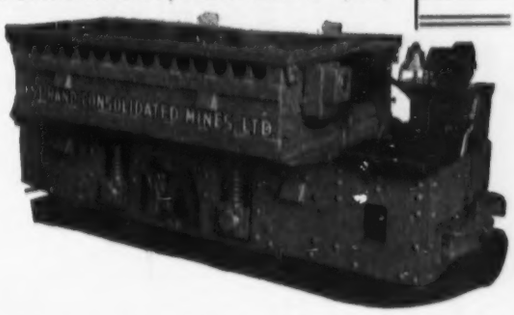

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Africa (*continued*)

this total, as well as the fatal accident rate per 1,000 of 1.36, being the same as the September figures. Fifteen of the October fatalities were caused by falls of ground. The total of gold mining fatalities for the first 10 months of 1945 is 415, the average number of employees being 346,077 and the accident rate per 1,000 was 1.44, compared with 1.42 for the whole of 1944.

★It is officially announced that the administration and control of New Transvaal Gold Farms, Ltd., which, among other interests, is the owner of over a quarter of a million acres of mineral rights including large areas of surface rights in the Transvaal and the Orange Free State, has been taken over by New Union Goldfields, Ltd.

★Statistics prepared by the Transvaal Chamber of Mines show that for the first 10 months of 1945 tons milled were 49,191,000; gold yield was 10,187,539 oz.; and working costs were £58,171,117, which is equivalent to 23s. 8d. per ton milled, and 118s. 6d. per ounce of gold.

★Union Government is investigating the possibility that Witwatersrand gold mine dumps contain uranium. It is also believed that much uranium exists in the Main Reef of the Witwatersrand. Diamonds first gave clue to radioactivity when a number of stones having a greenish color indicated that they had been exposed to radium rays. As far back as 1923 the Chemical, Metallurgical and Mining Society of South Africa was told at a meeting that a group of mines carried uraninite. From 600,000 tons of ore, 720 grams of radio-active concentrate were removed, which contained 44 percent uranium oxide and 127 mg. of radium to the ton.

If ore is found on a large scale anywhere in the Union, the government will consider the basis on which it should be exploited and whether, on grounds of high state policy, it should be appropriated as state property and excluded from private ownership, participation, or exploitation.

RUSSIA

Scientists employ planes to hunt for minerals in Caspian lowlands

★Important data on the geological structure of the Caspian lowlands was brought to Ashkhabad, Turkmenian, S.S.R., in November 1945, by a prospecting party of the Turkmenian Geological Administration which spent four and a half months surveying a vast area in the western section of the republic, from the coast of the Caspian Sea to the foothills of the Kopet-Dag Range and from Krasnovodsk to the lower reaches of the Atrek River.

Airplanes were used extensively by the prospectors to survey the area, which is covered for the most part by shifting sands and salt marshes. Geologists frequently landed from planes and made a thorough survey of a stretch of country until they reached a neighboring sector covered by another group of prospectors. In addition to speed, planes enabled scientists to study the relief of the land and properly define the distribution of geological formations.

In all, the party surveyed from the air and by land an area of 23,000 sq.km., which is believed to contain oil, ozocerite, sulphur, and other useful minerals.

A detailed study of the data obtained will provide a general picture of the geological structure of the Caspian lowlands and become the basis for compiling geological maps of the entire oil-bearing area in western Turkmenia. In addition to the formerly known oil strata, two new outcroppings of old quaternary strata were found which are regarded as possible indications of the presence of oil. Of great scientific interest is also the data on the history of the Caspian Sea and the relief of the sand dunes.

Stope Filling

(*Continued from Page* 121)

jor monoclinal fold has been encountered which flattens the ore and gives apparent horizontal thickening.

The footwall is generally graphitic slate rich in iron sulphide and quite combustible when exposed to air. It is very treacherous to handle during mining operations. The hanging wall in most cases is an iron formation which is cherty, fairly hard, and in general stands well in open stopes. In places, however, the black slate is found in both walls, which makes a difficult situation because it tends to slough off after being exposed to air. It therefore is necessary to leave 5 to 6 ft. of ore on both walls, which is not recovered.

The Stoping Method

Due to the size and shape of the orebody, together with a hard, dense structure of the ore, sublevel stoping has proved an efficient and economical method of mining. With minor changes it has been used since the mine was opened in 1893. Stope filling was never practiced, however, until recent years when pillar crushing and fires in the black slate forced the issue and methods were devised for filling all stopes.

Stope development is started while the driving of the main level haulage drifts is under way. The stoping system at present requires use of 40-ft. vertical pillars which run at right angles to the strike. Pillars between consecutive levels are kept directly in line vertically. Stopes are about 105 ft. long between pillars and extend from wall to wall. In cases where the ore is wider than 100 ft. a small longitudinal pillar is left, which is usually 25 ft. wide and which splits the stope area in half.

Until recent years, pillar thickness was kept at 25 ft. and stope length at 120 ft. With increasing depth, however, it was found that a slow but positive crushing action was taking place in the pillars and levels and it was necessary to increase the pillar size accordingly.

Development Work

Development of stopes is started by driving two 8x8-ft. subdrifts at right angles to the main heading and at about 8 ft. above the rail in the main drift. These are spaced 26 ft. 3 in. on either side of the stope center line and extend from wall to wall. With this spacing of the scraping drifts a uniform horizontal spacing of the mills is obtained which allows the ore to run freely into the scraping drifts. The mill raises are put up 13 ft. vertically from the ends of the stub drifts driven on alternate sides and at right angles to the scraper drift and are spaced 12 to 15 ft. c. to c. The stub drifts are 11 to 12 ft. long, which gives a distance of about 12 to 13 ft. between the center lines of the scraping drift and the mill raise. With this condition the ore usually flows freely into the scraping drift on its angle of repose, about 38 deg., without filling the scraping drift too full, and thereby clogging the scraping operation. By placing the mill raises this far back from the drift a safety measure is gained in that very few chunks coming from the open stopes can enter the drift with appreciable velocity so as to endanger any one passing.

Meanwhile a manway raise is put up from the side of the main heading and lying in the center of the pillar. This is advanced to the 25-ft. sublevel (actually 23 ft. above the main-level drift), from which point a drift is driven at 90 deg. to the scraping drifts below and as near center line longitudinally of the stope as possible. This drift is so located that it will connect with the nearest mill raise, which will be used as a chute for ore broken while drifting, and also to the furthermost mill raise in the stope, which will be called the mining raise. These three raises (manway, chute, and mining raises), are carried up and connected at 25-ft. intervals by subdrifts. This procedure is continued upward until the raises, except the chute raise, are connected to the main level above. The chute raise is stopped at the top sublevel. These raises are inclined with the dip of the ore and thus retain their relative position in the orebody.

All drift drilling is done by bar-mounted machines and raises are drilled by stopers. Scraper subs are equipped with 50-hp. a.c. tuggers and 60 in. scrapers. Development subs are equipped with 7½-hp. d.c. tuggers and 27-in. home-made scrapers.

Stoping as Done

Stoping is started on the 25-ft. sublevel by belling it out or enlarging around the mining raise. This is undercut far enough to allow a firm bench or "ring" around the raise. Benching or

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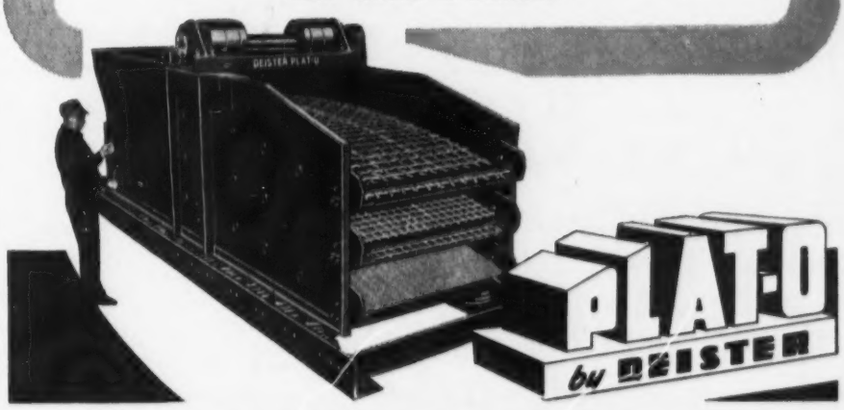

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SURFACE PLANT at M. A. Hanna Co.'s Hiawatha No. 2 mine, at Iron River, Mich. Stope filling as practiced at this property is described here.

Stope Filling *(Continued)*

belling out around the same raise can then be started on the 50-ft. sub. Upper holes are drilled from the 25-ft. sub, and the downholes, or "stope" holes, are drilled from the 50-ft. sub. Blasting then opens up the initial stages of the stope.

Stoping progresses upward in this fashion to the 150-ft. sublevel, which is 27 ft. below the haulage level. It is important that each bench undercuts the bench above, sufficiently to protect each crew from falling rock. As no upper holes are drilled from the 150-ft. stope, there is a floor pillar 20-ft. thick left under the main haulageway above. Stoping is then continued by retreating to the limits of the manway pillar.

Little trouble is experienced in caving the undercut benches. Each stope miner wears a safety harness fastened to a safety chain on each bench. In addition, drills mounted on vertical bars are used in place of stopers for all uppers. This eliminates the possibility of a machine throwing a man off a bench when he is collaring his holes.

Filling the Stopes

Reasons for filling the stopes, according to Mr. Koehler, are:

1. By filling, it has been possible to minimize the crushing effect on pillars.

2. Filling stops the caving of the black slate and the resulting fire hazard.

3. Filled stopes allow further mining in the pillars themselves, thus greatly increasing the recovery of good ore.

4. By filling, foul air in the mine is reduced, and the ventilation systems are more easily controlled.

Filling material must be obtained from the surface, as little development waste rock can be used, due to its generally high sulphur content and the resistant possibility of fire. In this area surface material fortunately is readily obtained from the overcapping of glacial drift, composed of clay, sand, gravel, and seams of hardpan. This can be handled with a power shovel and with minimum blasting.

In the past it has been the practice to drive twin raises from some upper level to surface. As the filling is received on the level it is either allowed to flow into the stopes, or is scraped by tuggers and scrapers to the tops of those stopes that are to be filled. As mining progresses downward, filled stopes are opened at the bottom and the filling is allowed to fill the stope below. The process of filling the uppermost stope is then repeated.

Filling Is Abrasive

Difficulty has been had with the stope-filling raises through the wearing action of the filling material. The raise gradually enlarges at points where the rock is soft, and eventually some caving occurs. This naturally tends to block the raise in its narrower parts. Two raises are provided: one admits the filling material, and the other serves as a manway and inspection raise, also allowing men to enter and blast out an obstruction.

Before any filling is run in, practically all openings must be sealed off with bulkheads, generally of steel or concrete. In some cases heavy cribbed timber has been used.

Water has been found to present the greatest hazard that has to be dealt with in stope-filling. For instance, in a plugged raise there is always the possibility of water building up behind the plugged portion and attaining considerable head before the plug is broken. This has happened in several cases, and sand, gravel, and boulders have washed out with tremendous velocity and filled vital drifts completely. To avoid this, an effort has been made to convey all water away from stope-filling operations and to inspect filled stopes regularly where possible.

Another occurrence of importance is the air-blast caused by the large volume of filling material flowing out of one stope into the stope below. This blast is lessened by leaving an opening on the level between stopes and letting the air escape through a series of staggered concrete bulkheads which act to stop the flow of sand but allow the passage of air.

Tests With Churn Drilling

Experiments are under way to determine the possibility of using churn-drill holes, reamed to large sizes, for

nilling stopes. At present one old stope is being filled thus. It was caving and a fire was beginning to smoulder. A 19-in. churn-drill hole was put down from surface, then reamed to 30 in., equipped with a grizzly. It was ready for filling within 45 days.

Another such hole is being drilled in a different area and still another, which is to be 1,900 ft. deep, is considered. The latter is so situated that all deep stopes can be handled from it by conveyor belts or by scraping.

There are instances where burning or caving stopes are so isolated that a raise could not be started from the vicinity. Here churn drilling would have a distinct advantage.

Ore Dressing

(*Continued from Page* 107)

from fourteen mines are treated, and therefore frequent reagent changes are necessary. The use of pH equipment facilitates control of metallurgy. Reagent feeder adjustments are made manually because, as Mr. Snyder points out, the functions of the many reagents used, coupled with the large variations in the quantities of soluble metal salts in the ores and numerous other variables, make it impractical to adopt automatic control for feeding reagents.

In the Mill City, Nev., concentrator of Nevada-Massachusetts Co., the pH is controlled automatically with a Beckman Model R indicator connected with a Bristol throttling type controller, with the diaphragm operating a variable transformer (Variac), which in turn regulates a Jeffrey vibrating feeder handling soda ash.

The Holden, Wash., mill of the Howe Sound Co., Chelan Division, employs an ingenious electronic control device for regulating the amount of frother fed to flotation, based on the rate of overflow of concentrates from the flotation machines.

Complex Sulphide Ores

Increased "know-how" in the selective flotation treatment of complex copper-lead-zinc sulphide ores is evident from the number of mills now handling with comparative ease ores of a type which only a few years ago were the source of many headaches.

Late in November 1945 the new lead-zinc concentrating unit of the Phelps Dodge Corporation, Copper Queen Branch, started production at

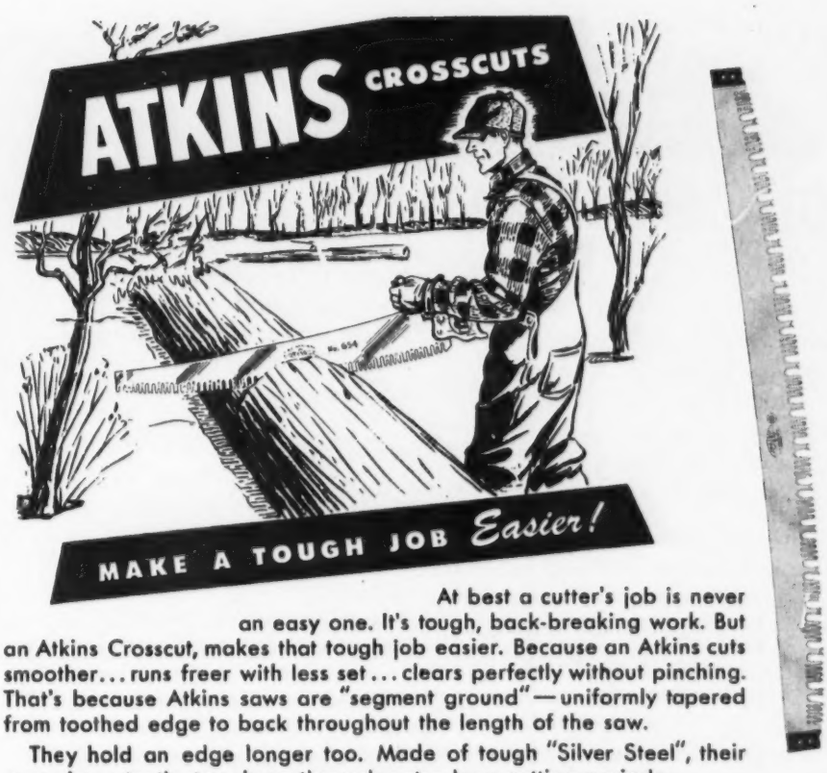

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Illustration above shows one of several types of one-man crosscut saws. At right is shown the No. 9 Atkins SILVER STEEL Crosscut, a typical example of numerous two-man saws in the line.

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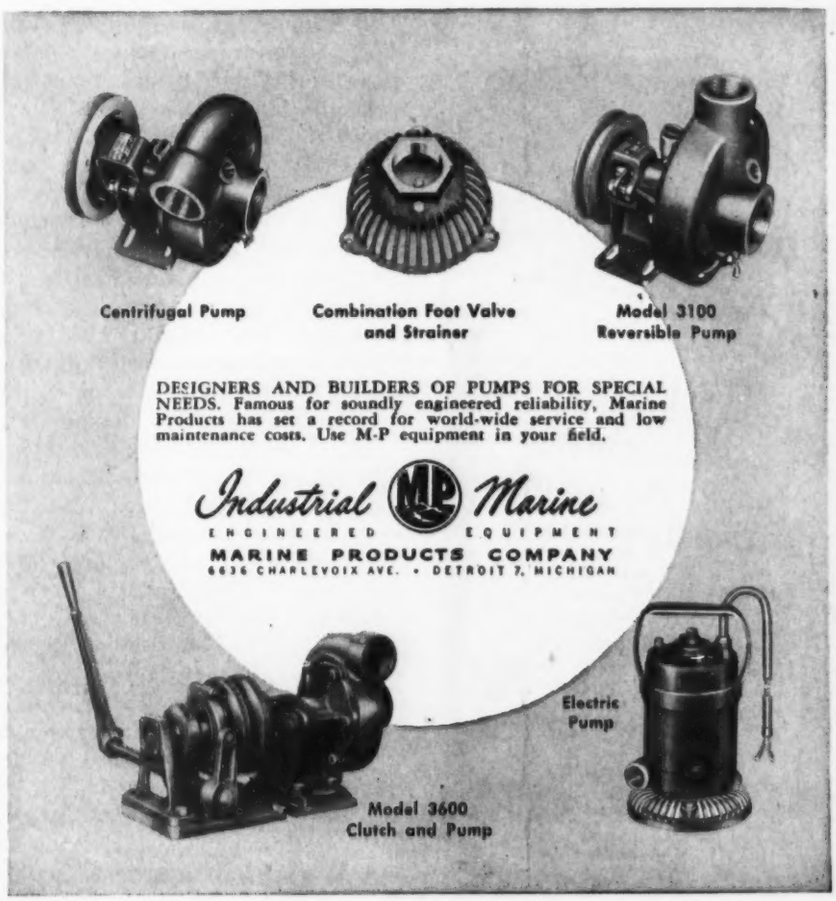
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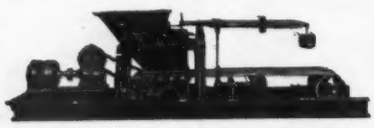

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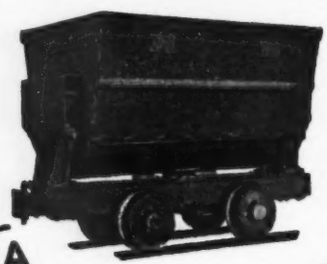

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Ore Dressing *(Continued)*

a rate of about 500 tons per day. The ore contains an appreciable amount of copper in addition to lead and zinc. Current mill practice is to recover a lead-copper concentrate and a zinc concentrate. Reagents used consist of sodium cyanide, zinc sulphate, Cyanamid's Reagent 130, for the lead-copper float; copper sulphate; lime ethyl xanthate, and amyl xanthate and cresylic acid for the zinc float. Excellent results are reported, and it is rumored that plans are already under way for increasing the size of this concentrator.

In progress this past year at Eagle-Picher's Sohuarita unit, in Arizona, and at the Mammoth-St. Anthony mill at Tiger, Ariz., were tests aimed at improving the separation of copper from lead by flotation. In contrast to several Mexican operations, where sulphur dioxide is the reagent used, the two Arizona mills were experimenting with cyanide. Results are said to be encouraging, but the tests are not yet at a stage where they may be reported on.

Three-Metal Separation

It is reported that an excellent copper-lead-zinc separation is being made in the new flotation mill operated by Idarado Mining Co. at the Treasury Tunnel, near Ouray, Colo. A new reagent combination and other milling features are effective in making a fine copper-lead separation yielding excellent concentrate grades and recoveries. Other refined milling features have resulted in a high-grade zinc concentrate. It is reported that the capacity of this mill is being increased to 500 tons, and eventually to 1,000 tons per day.

An interesting account of the operations of the 600-ton Grandview flotation concentrator of American Zinc, Lead & Smelting Co. by J. B. Huttl appears in an article entitled "Lead-Zinc" Flotation Problem Solved in Grinding Circuit" (*E&MJ*, May 1945). The use of screens in the fine crushing and grinding circuits to avoid over-grinding the coarse lead and zinc minerals contributes to the excellent metallurgical results obtained at this plant.

In the Southwestern copper camps, burdened through the early months of 1945 under war's demand for copper, peace brought at least a partial release of tension, and staffs of the big copper mills are engaged in planning, or in undertaking, various schemes for improving mill performance. For example, the flowsheet of the Morenci concentrator of Phelps Dodge Corporation has been changed so that total rougher concentrate is reground before cleaning.

Non-sulphide and Non-metallic Ores

Reflecting the rapidly increasing importance of flotation for the treatment of non-sulphide and non-metallic ores, several new plants were placed in operation during 1945.

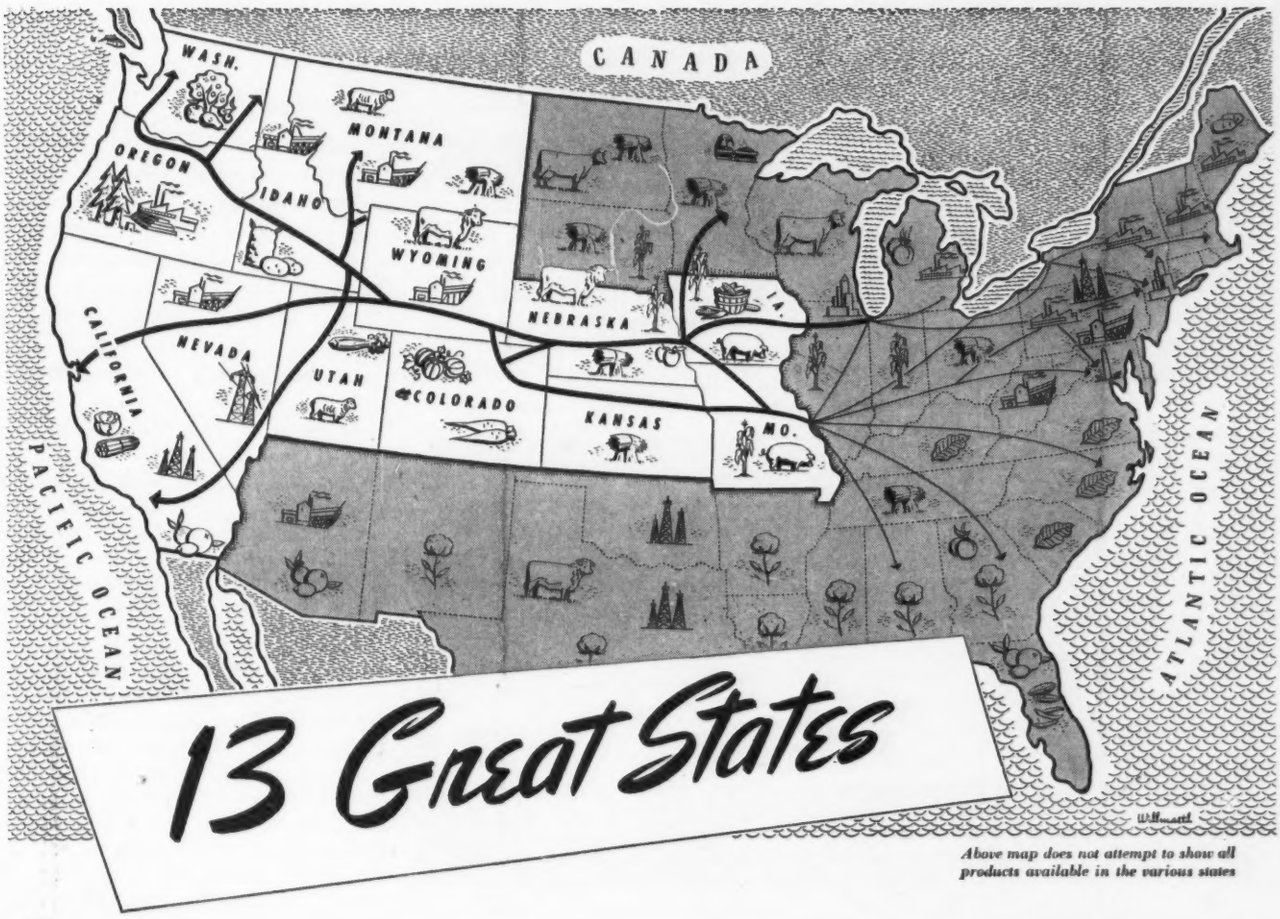
The Kona, N. C., feldspar flotation plant of Consolidated Feldspar Corporation which started operating last summer is the second one installed by that company, the original one being at Erwin, Tenn. Two other flotation plants for treatment of feldspar ores, one in North Carolina and the other in New Hampshire, are now under construction.

A flotation plant installed to treat a part of the tonnage normally treated by slime tables in the concentrator of the MacIntyre Development of National Lead Co. at Tahawus, N. Y., went into operation late last October. Encouraging results are reported. A flotation installation to treat garnet ore trailings is under construction by Barton Mines Corporation, North Creek, N. Y.

In Nevada, the recently remodeled concentrator of Nevada-Massachusetts Co. is treating scheelite ore at the rate of 350 to 400 tons per day. The minus-150-mesh portion of the ground ore is treated by flotation. A description of this operation appeared in an article entitled "Nevada Tungsten Ore Gets Three Way Treatment," presented in the July 1945 issue of *E. & M. J.*

A 15-ton-per-day pilot plant is reported to be in successful operation at the property of the Malagash Salt Co., Malagash, Nova Scotia. The purification problem involves the removal of clay and anhydrite.

The industry was saddened by the loss of many outstanding members of the mining profession during 1945, and in this connection the passing of Prof. R. H. Richards on March 27 during his 101st year deserves particular mention because of his



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For example, in Montana, Wyoming, Nevada, Utah and other states in Union Pacific territory, there is a large source of supply of steel, iron, copper, and other industrial metals. Union Pacific has the equipment and personnel to meet all the requirements of shippers in those regions.

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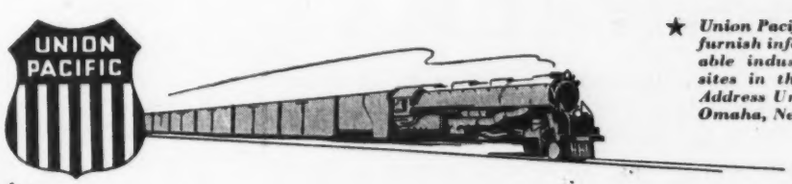

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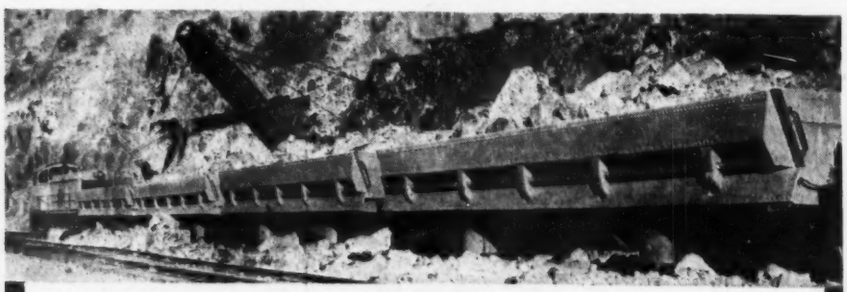

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Ore Dressing *(continued)*

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Non-Metallics Turn From War

(*Continued from page* 103)

velopment of the West, where low-priced electric power is being utilized to process the large available supplies of salt in that area and produce both soda and chlorine. Six of the eight chlorine plants in the West were operated in 1945, and every effort will be made to keep them in production.

Sulphur. Few industrial minerals received a greater impetus from the impact of war than sulphur. Sulphuric acid, the main compound of sulphur, plays an essential role in the manufacture of high explosives, in the refining of petroleum, in pickling baths for practically all metals, in the operation of storage batteries, and in the production of fertilizers. The drop in its consumption since V-J Day probably was due chiefly to the lower demand for explosives and certain metalliferous products. Petroleum refining and fertilizer manufacture, however, were maintained at a high level and are expected to call for large tonnages of sulphuric acid in 1946. The stocks of sulphur and productive facilities are ample to meet any foreseen demand.

Fluorine Minerals. The market for fluorspar in 1945 continued active, and although the quantity used as a flux will automatically decline as the production of steel and aluminum is curtailed, civilian demands for glass, tile, and enamel products, together with new uses for chemical-grade spar, should partly offset the lessened demand of the metallurgical industry.

The Bureau of Mines has developed flotation methods of beneficiating relatively lean fluorspar ores and has successfully concentrated metallurgical grades to meet the more rigid specifications of manufacturers of hydrofluoric acid. Consumption of this acid as a catalyst in the production of high-octane motor fuel and in insecticides, refrigerants, and various salts of fluorine continues to increase.